



# QUALITY ASSURANCE PROJECT PLAN RCRA ENVIRONMENTAL INDICATOR FOR CURRENT HUMAN EXPOSURE (CA-725)

## W.G. KRUMMRICH PLANT SAUGET, ILLINOIS

*Prepared for*  
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**URS**

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## GLOSSARY OF ACRONYMS AND ABBREVIATIONS

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%D	Percent difference
%R	Percent recovery
ABRTF	American Bottoms Regional Treatment Facility
AOC	Administrative order by consent
ARARs	Applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract laboratory program
COCs	Constituents of concern
CRDL	Contract required detection limits
DBMS	Database management system
DHU	Deep hydrogeologic unit
DQL	Data quality limits
DQO	Data quality objective
DSR	Duplicate sample result
EDD	Electronic disk deliverable
E&E	Ecology and Environment
ERA	Ecological risk assessment
FCR	Field change request
FSP	Field sampling plan
GC/MS	Gas chromatograph/mass spectrometer
HHRA	Human health risk assessment
HRGC	High-resolution gas chromatography
HRMS	High-resolution mass spectrometry
ICP	Inductively coupled plasma
LCS	Laboratory control sample
MDL	Method detection limit
MHU	Middle hydrogeologic unit
MS	Matrix spike
MSL	Mean Sea Level
MS/MSD	Matrix spike/matrix spike duplicate
MSD	Matrix spike duplicate
NIST	National Institute of Standards and Technology
OM	Operations manager
OSR	Original sample result
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PID	Photoionization detector
PM	Project manager
PQL	Practical quantitation limit
QA	Quality assurance
QC	Quality control
QA/QC	Quality assurance/quality control
QAM	Quality assurance management
QAO	Quality assurance officer
QAPP	Quality assurance project plan
RAM	Real-time aerosol monitor
RI/FS	Remedial investigation/feasibility study

## **GLOSSARY OF ACRONYMS AND ABBREVIATIONS**

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RPD	Relative percent difference
RPM	Remedial project manager
RSD	Relative standard deviation
SHU	Shallow hydrogeologic unit
SOP	Standard operating procedure
SR	Sample result
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
TOC	Total organic carbon
URS	URS Corporation
USCOE	United States Corp of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound

## SECTION ONE

## Project Description

### 1.0 ADMINISTRATIVE INFORMATION

Client Name:	Solutia, Inc.
Site Location:	Sauget, Illinois
Program Manager:	Robert Billman
Project Manager	Jeff Adams
Site Safety Officer:	To be determined
Effective Dates:	November 2002 to December 2003

### APPROVAL:

\_\_\_\_\_  
Robert Billman  
URS Project Officer

\_\_\_\_\_  
Date

\_\_\_\_\_  
Amelia Turnell  
URS Quality Assurance Officer

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Date

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Jack Tuschall, Ph.D.  
STL – Savannah General Manager

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Date

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Richard Williams  
Solutia Project Manager

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Date

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Ken Bardo  
USEPA Region V RPM

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Date



## SECTION ONE

## Project Description

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### 1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by URS Corporation (URS) on behalf of Solutia Inc. as part of the RCRA Environmental Indicator (EI) evaluation for current human exposures at the W.G. Krummrich Plant in the Village of Sauget, Illinois. This QAPP provides objectives, organization, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities for sampling, sample handling and storage, chain of custody, and laboratory and field analysis efforts associated with sampling of environmental media for this project.

This QAPP was developed using the following documents as guidance:

- USEPA Region V *Model Quality Assurance Project Plan (QAPP) Revision 1* (USEPA, 1996b)
- USEPA *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. QAMS-005-80 (USEPA, 1980)
- USEPA *Requirements for Quality Assurance Project Plans for Environmental Data Operation*, USEPA QA/R-5, (USEPA, 1994b).

The following quality assurance topics are addressed in this QAPP:

- Project description
- Project organization and responsibilities
- Quality assurance objectives for measurement
- Sampling procedures
- Custody procedures
- Calibration procedures and frequency
- Analytical procedures internal quality control checks
- Data reduction, validation, and reporting
- Performance and system audits
- Preventative maintenance

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- Specific routine procedures used to assess data precision, accuracy, and completeness
- Corrective action
- Quality assurance reports to management.

A complete site description for the W.G. Krummrich Plant is provided in the Description of Current Conditions Report (DOCC) dated August 1, 2000 (Solutia, 2000). This reference contains a discussion of site location, physical setting, present and past facility operations and disposal practices, regional and site-specific geology, hydrology, and hydrogeology, current and past groundwater uses, surrounding land use and populations, sensitive ecosystems, and meteorology/climatology.

### 1.2 PROJECT OBJECTIVES

The purpose of the work is to gather sufficient information from the W.G. Krummrich Plant to complete the Current Human Exposure EI Report. The collected data will be used to prepare a Human Health Risk Assessment (HHRA). The Field Sampling Plan (FSP) includes a description of the sample collection protocols, sample locations, number of samples, and analytical methods.

The purpose of the QAPP is to describe the guidelines to be followed in implementing the FSP to ensure that the data collected and the decisions made based on those data are technically sound, valid, and properly documented. Data Quality Objectives (DQOs), according to USEPA's guidance (EPA 1993), are statements that identify data uses, data types, data quantity and quality (including reporting limits), and ensure that the collected data will fulfill the sampling program project objectives.

The analytical methods to be used will be SW-846 methods and are presented in **Table 1**.

The main components of the FSP addressed in this QAPP include:

- Surface soil sampling
- Subsurface soil sampling.

Key elements of a data collection and quality assurance program include a description of the data collection strategy, procedures for sample selection and collection, procedures for field measurements, and procedures for ensuring sample integrity. The rationale and strategy of the investigation program design is presented in the FSP. This QAPP specifies the procedures that

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### **Project Description**

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will be implemented to ensure that the sampling and analysis activities are consistent with the project quality goals.

#### **1.3 PROJECT SCHEDULE**

The estimated project schedule is presented in the FSP. It is estimated that the field investigation, laboratory analysis of samples collected, data interpretation, and submittal of the FSP report will take approximately 4 to 5 months from the workplan approval.

## **SECTION TWO**

### **Project Organization and Responsibility**

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URS will perform the soil sampling activities, validate and interpret the data, prepare the report and provide project management for support sampling activities. Analytical services for this QAPP will be provided by Severn-Trent Laboratories located in Savannah, Georgia and Sacramento, California. ENSR will perform the Human Health Risk Assessment. The various quality assurance and management responsibilities of key project personnel are defined below.

#### **2.1 PROJECT ORGANIZATION**

Sections 2.2 through 2.5 of this QAPP present the responsibilities of the key project personnel, and the lines of authority for the project personnel are described in each section.

#### **2.2 MANAGEMENT RESPONSIBILITIES**

##### **2.2.1 USEPA Region V Remedial Project Manager**

The USEPA Region V Remedial Project Manager (USEPA RPM) for this project will be Ken Bardo.

##### **2.2.2 Solutia Project Manager**

Richard Williams of Solutia Inc. will serve as the Solutia Project Manager. As such, he will have the overall responsibility for all phases of the work. He will be responsible for implementing the project, and will have the authority to commit the resources necessary to meet project objectives and requirements. His primary function is to verify that technical, financial, and scheduling objectives are achieved successfully. He will provide the major point of contact and control for matters concerning the project. The Solutia Project Manager will:

- Define project objectives and develop a sampling plan schedule
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task
- Acquire and apply technical and financial resources as needed to verify performance within budget and schedule constraints
- Monitor and direct the field leaders
- Develop and meet ongoing project staffing requirements
- Review the work performed on each task to verify its quality, responsiveness, and

## **SECTION TWO**

### **Project Organization and Responsibility**

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timeliness

- Review and analyze overall task performance with respect to planned requirements and authorizations
- Approve reports before their submission to USEPA Region V
- Ultimately be responsible for the preparation and quality of reports
- Represent Solutia at meetings.

#### **2.2.3 URS Project Officer**

Robert Billman will serve as the URS Project Officer. He will be responsible for the overall administration and technical execution of the project. He will report directly to the Solutia Project Manager.

#### **2.2.4 URS Project Manager**

Jeff Adams will serve as the URS Project Manager (PM). He will have overall responsibility for verifying that the project meets the stated objectives and URS's quality standards. He will report directly to the URS Project Officer and is responsible for technical quality control and project oversight.

### **2.3 QUALITY ASSURANCE (QA) RESPONSIBILITIES**

#### **2.3.1 URS Data Validator**

John Kearns of URS will serve as the lead third party data validator. He will remain independent of direct job involvement and day-to-day operations and have direct access to corporate executive staff as necessary to resolve QA disputes. The data validator will be responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, URS's policies, and USEPA requirements. The specific functions that he or a designee perform may include:

- Providing QA audits on various phases of the field operations
- Reviewing and approving the QA plans and procedures
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the URS Project Officer

## **SECTION TWO**

### **Project Organization and Responsibility**

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- Data validation of sample results from the analytical laboratory, as appropriate.

#### **2.3.2 URS QA Officer**

Amelia Turnell will serve as the URS QA Officer (QAO). She will report directly to the URS Project Officer and will be responsible for verifying that all URS QA procedures for this project are being followed.

#### **2.3.3 USEPA Region V Quality Assurance Reviewer**

Ken Bardo, the USEPA Region V RPM, or a designee, will serve as the USEPA Region V Quality Assurance Reviewer. He will have the responsibility to review and approve the QAPP. In addition, he will be responsible for conducting any external performance and system audits of the laboratory and field activities. He will also review and evaluate analytical laboratory and field procedures.

### **2.4 FIELD RESPONSIBILITIES**

#### **2.4.1 URS Field Team Leader**

Jeff Adams, Steven Bunsen, or a designee, will serve as the URS Field Team Leader. The Field Team Leader will be responsible for leading, coordinating, and supervising the day-to-day field activities. His responsibilities include:

- Provision of day-to-day coordination with the URS Project Officer on technical issues
- Develop and implement field-related sampling plans and schedule
- Coordinate and manage field staff
- Supervise or act as the field sample custodian
- Implement the QC for technical data, including field measurements
- Adhere to work schedules
- Coordinate and oversee technical efforts of subcontractors assisting the field team
- Identify problems at the field team level, resolve difficulties in consultation with the URS Project Officer, implement and document corrective action procedures, and provide communication between team and upper management

## **SECTION TWO**

## **Project Organization and Responsibility**

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### **2.4.2 URS Field Team**

The technical staff will be drawn from URS' pool of resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. The technical staff consists of experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

### **2.4.3 Health and Safety Officer**

The Health and Safety Officer will be responsible for implementing the site-specific health and safety directives in the Health and Safety Plan and documenting all health and safety related activities. The Field Team leader may serve as the Site Health and Safety Officer.

## **2.5 LABORATORY RESPONSIBILITIES**

### **2.5.1 Laboratory Project Manager**

Laboratory project managers will report directly to the URS QA Officer and will be responsible for the following:

- Ensuring the resources of the laboratory are available on an as-required basis
- Reviewing the final analytical report
- Approving final analytical reports prior to submission to the data validation contractor.

### **2.5.2 Laboratory Operations Manager (OM)**

Laboratory operations managers will report to their respective Laboratory PM and will be responsible for:

- Coordinating laboratory analysis
- Supervising in-house chain-of-custody
- Scheduling sample analysis
- Overseeing data review
- Overseeing preparation of analytical reports
- Approving final analytical reports.

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## **Project Organization and Responsibility**

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### **2.5.3 Laboratory Quality Assurance Officer**

Laboratory quality assurance officers will have overall responsibility for data after it is released by the analyst and before it is released by the laboratory. The Laboratory QAO will be responsible for the following:

- Overseeing laboratory quality assurance
- Overseeing Quality Assurance/Quality Control (QA/QC) documentation
- Conducting detailed data review
- Deciding whether to implement laboratory corrective actions, if required
- Defining appropriate laboratory QA procedures
- Preparing laboratory standard operation procedures (SOPs)
- Approving the laboratory QAPP.

### **2.5.4 Laboratory Sample Custodian**

Laboratory sample custodians will report to their respective Laboratory OM. Their responsibilities will include the following:

- Receiving and inspecting the incoming sample containers
- Recording the condition of the incoming sample containers
- Signing appropriate documents
- Verifying the chain-of-custody and its correctness
- Notifying the Laboratory PM of sample receipt and inspection
- Assigning a unique identification number and entering each into the sample receiving log
- Controlling and monitoring access and storage of samples.

Final responsibility for the project quality rests with the URS Project Officer. Independent quality assurance will be provided by each Laboratory PM and Laboratory QAO prior to release of all data to URS.



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### **Project Organization and Responsibility**

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#### **2.5.5 Laboratory Technical Staff**

The laboratory technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to their respective Laboratory OM.

## **SECTION THREE**

### **Quality Assurance Objectives for Measurement**

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The overall QA objective for this QAPP is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, data measurement and reporting providing data to a degree of quality consistent with its intended use and legally defensible in a court of law. Quality assurance objectives for measurement data are usually expressed in terms of precision, accuracy, completeness, representativeness, and comparability. The investigation will not be considered invalid if these criteria are not fully achieved but variances will trigger QA/QC measures to evaluate, and correct if necessary, any problem areas.

The control limits for precision and accuracy as well as detection limits for each laboratory analysis are listed in **Tables 2A** through **2E**.

#### **3.1 PRECISION**

##### **3.1.1 Definition**

Precision is a measure of the degree to which two or more measurements are in agreement.

##### **3.1.2 Field Precision Objectives**

Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per ten analytical samples. The total number of duplicates for this QAPP is found in **Table 3**.

##### **3.1.3 Laboratory Precision Objectives**

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) for two or more replicate samples. The equations to be used for precision in this QAPP are presented in Chapter 12 of this QAPP. Precision control limits are presented in **Tables 2A** through **2E**.

#### **3.2 ACCURACY**

##### **3.2.1 Definition**

Accuracy is the degree of agreement between an observed value and an accepted reference value.

##### **3.2.2 Field Accuracy Objectives**

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation, and holding times.

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## **Quality Assurance Objectives for Measurement**

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### **3.2.3 Laboratory Accuracy Objectives**

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or laboratory control samples (LCSs), and the determination of percent recoveries. The equation to be used for accuracy in this QAPP is presented in Chapter 12. Accuracy control limits are presented in Tables 2A through 2E.

### **3.3 COMPLETENESS**

#### **3.3.1 Definition**

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

#### **3.3.2 Field Completeness Objectives**

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Field completeness for this project will be greater than 90 percent. In the event that the field completeness target of greater than 90 percent is not achieved, additional samples may be collected and analyzed so that the 90 percent goal will be achieved or a report will be issued explaining why the goal was not met and if the task can be considered complete.

#### **3.3.3 Laboratory Completeness Objectives**

Laboratory completeness is a measure of the amount of valid measurements obtained from all the laboratory measurements taken in the project. The equation for completeness is presented in Chapter 12 of this QAPP. Laboratory completeness for this project will be greater than 95 percent. In the event that the laboratory completeness target of greater than 95 percent is not achieved, additional samples may be collected and analyzed so that the 95 percent goal will be achieved or a report will be issued explaining why the goal was not met and if the task can be considered complete.

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## **Quality Assurance Objectives for Measurement**

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### **3.4 REPRESENTATIVENESS**

#### **3.4.1 Definition**

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

#### **3.4.2 Measurement to Ensure Representativeness of Field Data**

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used.

#### **3.4.3 Measures to Ensure Representativeness of Laboratory Data**

Representativeness in the laboratory data is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing the field duplicate samples and matrix spike duplicate samples. The sampling network is designed to provide data representative of site conditions. During development of this network, consideration is given to existing analytical data, past site practices, and physical setting and processes.

### **3.5 COMPARABILITY**

#### **3.5.1 Definition**

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability can be related to precision and accuracy since these quantities are measures of data reliability.

#### **3.5.2 Measures To Ensure Comparability of Field Data**

Samples from the same media are considered comparable if the procedures for collecting the samples are complied with and if the units of measurement are the same.

#### **3.5.3 Measures to Ensure Comparability of Laboratory Data**

Comparability is assured through the use of a laboratory for this project that uses established and approved analytical methods, protocols, and a laboratory quality control program designed to

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### **Quality Assurance Objectives for Measurement**

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establish consistency in the performance of the analytical process. All data will be subjected to strict QA/QC procedures and reported in a consistent manner to allow for comparison across data sets.

#### **3.6 SENSITIVITY**

##### **3.6.1 Definition**

Sensitivity refers to a measurable concentration of an analyte which has an acceptable level of confidence.

##### **3.6.2 Measures to Ensure Comparability of Laboratory Data**

Sensitivity is measured through the determination of detection limits for each analytical method. Method detection limits (MDLs) are the lowest concentration of an analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. Practical quantitation limits (PQLs) are levels above the MDLs at which the laboratory has demonstrated the quantitation of analytes. The sensitivity of the analytical methods is dependent upon whether the methods associated with this project have PQLs and MDLs at sufficiently low levels to adequately assess the project DQOs. Field sampling personnel, the analytical laboratory, the data validator and risk assessors (human health) will work together to ensure that PQLs are as low as feasible for the media being sampled and that sample analytical results will achieve data quality levels (DQLs) within the limits of the selected analytical method. The PQLs and MDLs are presented in **Tables 2A through 2E**. The PQLs and MDLs presented in the VOC table for soil are based on USEPA Method 5035 preparation procedure.

#### **3.7 LEVEL OF QUALITY CONTROL EFFORT**

Field blanks, trip blanks, method blanks, duplicates, and matrix spikes/matrix spike duplicates samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

The following are the field and laboratory QA/QC measures used to evaluate data quality.

A field blank (or equipment blank) will be collected and submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples. Field blanks consist of distilled or de-ionized water which is poured over cleaned sampling equipment in between sample collections. Field blanks are analyzed to check for procedural contamination

## **SECTION THREE**

### **Quality Assurance Objectives for Measurement**

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at the site which may cause sample contamination. The minimum required is one per every ten samples or one per sampling day if less than ten samples are collected, unless dedicated sampling equipment is used to collect samples.

A trip blank must be included in each cooler which contains samples for VOC analysis and is analyzed by the laboratory for VOCs for all sites at which VOCs are one of the analytical parameters. The trip blank consists of organic-free water placed in one or more VOC vials, and is transported to the sampling site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. Trip blanks are used to assess the potential for VOC contamination of samples due to constituent migration during sample shipment. One trip blank is required for each shipping container which contains samples collected for VOC analysis.

Method blanks are used to assess contamination resulting from the laboratory procedures. The laboratory must run a method (preparation) blank at the beginning of each analytical run for each day that the analysis is performed. If not all sample analyses are completed in one day, a minimum of one method blank per sample matrix per analytical method must be run at the beginning of each sample batch analyzed each day.

Field duplicates must be collected for each matrix sampled. Field duplicate samples are analyzed as a check of sampling and analytical reproducibility; laboratory duplicates provide an estimate of the reproducibility of measurement. The field duplicate will be analyzed for all parameters for which the investigative samples of that matrix are analyzed. The minimum number of field duplicates required is one per every ten samples or, if there are fewer than ten samples, one per matrix.

Matrix spikes (MSs) provide information about the effect of the sample matrix or digestion and measurement methodology. MSs for organic analyses will be performed in duplicate (MSD). The spike duplicate will be performed for inorganic analyses. MS or spike duplicate samples will be collected at a frequency of one for every twenty samples collected, or, if fewer than twenty samples per matrix, one for each matrix sampled. The MS/MSD and spike duplicate is an investigative sample which (for each applicable analytical parameter for that sample matrix) is spiked with target analytes for that analytical procedure, and analyzed with the other samples of that matrix. Samples chosen as MS/MSD and spike duplicates should be selected prior to the sampling event so that sufficient sample volume is acquired.

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### **Quality Assurance Objectives for Measurement**

Laboratory control samples (LCSs) are standard solutions that consist of known concentrations of the target analytes spiked into laboratory organic-free distilled water or clean sand. They are prepared or purchased from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with all target analytes for each analysis. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze an LCS with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time (within same 12-hr period) for gas chromatograph/mass spectrometer (GC/MS) analysis. Percent recoveries will be evaluated using laboratory established control limits to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

Upon initiation of an analytical run, the laboratory must perform calibration procedures as instructed by the analytical methods used. During the length of the run, calibration verifications must be performed at the frequency specified to verify the initial calibration.

Surrogates must be added to all samples for organic analysis. Surrogate recovery will be used to assess accuracy of organic analyses.

Control limits are the maximum and/or minimum values which define a range for a specific parameter, as outlined within each analytical procedure, at which sample results are considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is or becomes out-of-control, corrective action must be taken to bring the analysis back into control. The corrective action must include:

1. Finding the cause of the problem
2. Correcting the problem
3. Demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples
4. Repeating the analysis of any investigative samples that may have been affected by the control problem.

## **SECTION THREE**

### **Quality Assurance Objectives for Measurement**

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Exceptions will be made on a case-specific basis. Documentation must include evidence that a good-faith effort was made to meet the control limit; this may include two attempts to analyze the sample.

The following are the field equipment QC efforts for the project:

Field analytical equipment will be calibrated prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the URS PM and will be subject to audit by the URS QAO. Copies of all of the instrument manuals will be maintained on-site by the URS Field Team Leader.

The QC effort for photoionization detector (PID) measurements will include calibration checks using calibration gas which will be performed immediately prior to each day's use and more frequently if required.

The QC effort for explosimeter measurements will be maintained by using a simultaneous zero calibration and span calibration procedure maintained in accordance with the manufacturer's annual recommendations.

The QC effort for real-time aerosol monitor (RAM) measurements will be maintained by using an internal calibration method installed by the factory when the instrument is manufactured. The factory calibrates the instrument to the standard ISO 12103-1, A1 test dust. The calibration data is stored internally and cannot be accessed. This standard test dust is used because of its wide particle size distribution which makes the internal calibration representative of an average of most types of ambient aerosol that may be encountered.



## SECTION FOUR

### Sample Procedures

The following sampling procedures and practices that will be used in conducting this work are presented in the FSP and in the Health and Safety Plan:

- Soil sampling
- Sample custody procedures
- Decontamination procedures.

The sample identification system will involve the following:

- Soil samples will be labeled SOIL-WGK-S1-\_\_FT where “SOIL” denotes a soil sample, “WGK” is the site designation, “S1” is the sequentially numbered sampling station, and “\_\_FT” indicates the sample depth range (e.g., 0-2).
- “MS/MSD” or “DUP” at the end of a sample identification will indicate a matrix spike/matrix spike duplicate/spike duplicate or a duplicate sample, respectively.

**Table 3** lists the sample volumes suggested for soil samples collected for this project, as well as the holding times, the proper containers, and the required preservation. The QC samples to be collected including field duplicates, field blanks, MS/MSDs, and spike duplicates are also presented in the **Table 3**.

Care should be taken that sufficient sample volume is provided for all necessary analyses to be performed. This applies to field blanks, field duplicates, and MS/MSD/spike duplicate samples as well as for investigative samples. This is most easily accomplished by specifying that samples are collected in specific sizes and types of containers which provide sufficient volume (and meet other necessary criteria) for the particular types of analyses that will be performed. Samples designated for use as the MS/MSD require additional volume for organic analysis.

## **SECTION FIVE**

### **Custody Procedures**

Chain-of-custody procedures will be instituted and followed throughout the investigation. Custody is one of several factors necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory activities, and final evidence files. Final evidence files, including all originals of laboratory reports, are maintained under document control in a secure area. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The URS QAO must be prepared to produce documentation that traces the samples from the field to the laboratory. The USEPA has defined custody of evidence as follows:

- In actual possession
- In view after being in physical possession
- In a locked location
- In a designated, secure, restricted area.

#### **5.1 FIELD CUSTODY PROCEDURES**

The field samplers are personally responsible for the care and custody of the sample until transferred. In the field sampler's individual bound field notebook, samplers will note, with permanent ink, meteorological data, equipment employed for sample collection, calculations, information regarding collection of QA/QC samples, and any observations. All entries will be signed and dated, and any entry which is to be deleted shall use a single cross-out which is signed and dated. The following types of information will be recorded in the field notebook by the field sampling team:

- Sample number
- Project identification
- Sampling location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample
- Sampling technique

## SECTION FIVE

### Custody Procedures

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- Preservation used if applicable
- Sampling conditions
- Observations
- Initials of the sampler.

A sample label, which is shown in **Figure 1**, will each be attached to each investigative or QC sample and the sample placed in a shipping container. A sample custody seal (**Figure 2**) will be applied to the coolers. The following will be recorded with permanent ink on sample labels and on chain-of-custody records by the field sampling team:

- Project name and number
- Sample number identification
- Initials of sampler
- Sampling location (if not already encoded in the sample number)
- Required analysis
- Date and time of sample collection
- Space for laboratory sample number (only on the sample tag)
- Preservative used, if applicable.

The sample identification system to be used in the field is described in Chapter 4 of this QAPP.

The field sampling team will send the coolers to the designated laboratory. Samples will not be sent to another laboratory without the permission of USEPA Region V.

The laboratory will assign a number for each sample upon receipt.

A sample chain-of-custody form will be completed for each shipment to the analytical laboratory. The chain-of-custody will include the following information:

- Project identification and number
- Sample description/location
- Required analysis

## SECTION FIVE

### Custody Procedures

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- Date and time of sample collection
- Type and matrix of sample
- Number of sample containers
- Analysis requested/comments
- Sampler signature/date/time
- Air bill number.

A chain-of-custody document providing all information, signatures, dates, and other information, as required on the example chain-of-custody form in **Figure 3**, will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. The field sampler will sign the chain-of-custody record when relinquishing custody, and include the original form in an air-tight plastic bag in the sample cooler with the associated samples. Sampling containers will be packed to help prevent breakage and cross-contamination. Samples will be shipped in coolers, each containing a chain-of-custody and ice and ice packs to maintain inside temperature at approximately 4°C. Sample coolers will then be sealed between the lid and sides of the cooler with two custody seals prior to shipment. The custody seals will consist of adhesive-backed tape that easily rips if it is disturbed. Samples will be shipped to the laboratory by common overnight carrier or will be delivered by URS. Samples will be packed following applicable DOT requirements.

Samples will remain in the custody of the sampler until transfer of custody is completed. Transfer consists of:

- Delivery of samples to the laboratory sample custodian
- Signature of the laboratory sample custodian on the chain-of-custody document as receiving the samples and signature of sampler as relinquishing the samples.

If a carrier is used to take samples between the sampler and the laboratory, a copy of the air bill must be attached to the chain-of-custody to maintain proof of custody, and the air bill number must be written on the chain-of-custody.

## **SECTION FIVE**

### **Custody Procedures**

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#### **5.2 LABORATORY CUSTODY PROCEDURES**

Laboratory custody procedures begin when the laboratory receives the samples. When the samples arrive at the laboratory, either the mail room custodian or the sample custodian (identified in Chapter 2) will sign the vendor's air bill or bill of lading (unless hand-delivered) and the chain-of-custody. The sample custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples.
- Inspect sample shipping containers for the presence or absence of custody seals (only if shipped via overnight courier) and for container integrity.
- Check the cooler temperature and record on the chain-of-custody. If the cooler temperature is greater than 10°C, the URS QAO will be contacted.
- Sign and date the appropriate forms or documents, verify and record the agreement or disagreement of information on sample documents, and, if there are discrepancies, record the problem and notify the Laboratory QAO.
- Log sample information into the laboratory sample tracking system, including:
  - date and time of sample receipt
  - project number
  - field sample number
  - laboratory sample number (assigned during log-in procedure)
  - sample matrix
  - sample parameters
  - storage location
  - log-in person's initials
- Label sample with a unique, sequential laboratory sample number.
- Place samples in the walk-in cooler, or sample storage area which is a secure, limited-access storage. The samples collected for volatile analysis will be stored in a separate refrigerator.

## SECTION FIVE

### Custody Procedures

At the laboratory, the analyst will be required to log samples and extracts in and out of storage as the analysis proceeds. An example of the laboratory internal chain-of-custody form is provided as **Figure 4**. Samples and extracts will be returned to secure storage at the close of business. Written records will be kept of each time the sample or extract changes hands. Care must be exercised to properly complete, date, and sign items needed to generate data.

The laboratory must use the following procedures:

- Samples will be handled by the minimum number of people possible.
- The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room, which is capable of being locked.
- A specific person will be designated sample custodian. Incoming samples must be received by the custodian who will indicate receipt by signing the chain-of-custody form.
- The custodian will ensure that samples which are heat-sensitive, light-sensitive, radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis.
- The analytical area will be restricted to authorized personnel only.
- After sample analyses are complete, the laboratory may discard samples one month after the date on the final report. Analytical data is to be kept secured and released to authorized personnel only.

### 5.3 FINAL EVIDENCE FILE CHAIN-OF-CUSTODY PROCEDURES

The final evidence file will be the central repository for documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. URS is the custodian of the evidence file and maintains the contents of evidence files for the site, including relevant records, logs, field notebooks, pictures, subcontractor reports, and data reviews.

Copies of the following will be stored by the laboratory for incorporation into the sample file, if requested; the Laboratory OM will be responsible for final evidence documentation assembly:

- Documentation of the preparation and analysis of samples, including copies of the analysts' notebooks

## **SECTION FIVE**

### **Custody Procedures**

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- Bench sheets, graphs, computer printouts, chromatograms, and mass spectra, as applicable.
- Copies of QA/QC data.
- Instrument logs showing the date, time, and identity of the analyst.
- Analytical tracking forms that records the date, time, and identity of the analyst for each step of the sample preparation, extraction, and analysis.

Upon completion of the analyses, the URS QAO will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the sample will consist of the following:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, and sample preparation logs.
- Chain-of-custody records.
- Data validation reports.

The following documentation will supplement the chain-of-custody records:

- Field notebooks and data
- Field collection report
- Pictures and drawings
- Progress and QA reports
- Contractor and subcontractor reports
- Correspondence.

The evidence file must be maintained in a secured, limited access area until submittals for the project have been reviewed and approved, and for a minimum of six years past the submittal date of the final report.

## **SECTION SIX**

### **Calibration Procedures and Frequency**

Calibration is a reproducible reference point in which all sample measurements can be correlated. A sound calibration program shall include provisions for documentation of frequency, conditions, standards, and records reflecting the calibration history of a measurement system. The accuracy of the calibration standard is important because all data will be in reference to the standards used.

Proper calibration of laboratory analytical instrumentation and field instrumentation is essential for the generation of reliable data which meets the project's DQOs. Analytical instrument calibration is monitored through the use of control limits which are established for individual analytical methods. Calibration procedures to be followed are specified, in detail. These procedures specify the type of calibration, calibration materials to be used, range of calibration, and frequency of calibration. For field analyses, calibrations must be performed and documented on the instrumentation used.

#### **6.1 FIELD EQUIPMENT CALIBRATION**

Field equipment that will be used to collect data on organic vapors, on-site dust concentrations, and explosive atmospheres will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Field instruments to be used that require calibration include, but are not limited to, the following:

- HNu® PL-101, DL-101 PID, or Photovac MicroTIP® detector (or equivalent)
- Neotronics Mini Gas 4® Portable 4-in-1 Multi-Gas Monitor (explosimeter) (or equivalent)
- Dusttrak® Model 8520 RAM or equal (or equivalent).

Equipment to be used for the field sampling will be examined to confirm that it is in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to confirm that the maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notations on any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. Readily available spare parts will be maintained at the field office.

In general, instruments will be calibrated prior to each day's use and will be recalibrated as



## **SECTION SIX**

### **Calibration Procedures and Frequency**

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required. Where applicable, the linearity of the instrument will be checked by using a two-point calibration with reference standards bracketing the expected measurement. Instrument-specific operation manuals will be consulted if further detail is required. All calibration procedures performed will be documented in the field logbook.

Copies of the manufacturer's operations manuals for all field instruments to be used will be kept on-site during the field efforts. These manuals will be used for all calibration and operation activities.

#### **6.2 LABORATORY EQUIPMENT CALIBRATION**

The laboratory will be responsible for proper calibration and maintenance of laboratory analytical equipment. Calibration procedures are presented in the analytical methods and the laboratory SOPs. **Tables 4A through 4F** present the specific calibration criteria and the conditions that will require recalibration for each method. Calibration procedures for a specific laboratory instrument will consist of initial calibration, initial calibration verification, and continuing calibration verification. The SOP for each analysis listed in **Table 5**, describes the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, date of calibration, analyst, calibration solutions, and the samples associated with the calibrations.

The USEPA calibration procedures and frequencies are specified in the USEPA organic and inorganic methods listed in **Table 1**.

#### **6.3 STANDARDS AND SOLUTIONS**

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory materials including solutions, standards, and reagents. Standards and standard solutions are obtained from the USEPA or commercial vendors. Certificates of analysis are included with each standard by the vendor.

Standards and standard solutions are verified prior to use. This verification may be in the form of a certification from the supplier. Standards may also be verified by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of

## **SECTION SIX**

### **Calibration Procedures and Frequency**

deterioration, including unusual volume changes, discoloration, formation of precipitates, or changes in analyte response.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

#### **6.4 RECORDS**

A records book will be kept for standards and will include the following information:

- Material name
- Control or lot number
- Purity and/or concentration
- Supplier/manufacturer
- Receipt/preparation date
- Recipient's/preparer's name
- Expiration date.

These records will be checked periodically as part of the laboratory internal laboratory controls review.

#### **6.5 CALIBRATION RECORDS**

A bound notebook will be kept with each instrument that requires calibration. The notebook will contain a record of activities associated with QA monitoring and instrument repairs. These records will be checked during periodic equipment review and internal and external QA/QC audits.

## **SECTION SEVEN**

## **Analytical Procedures**

Soil samples collected for this project will be analyzed by Severn-Trent Laboratories located in Savannah, Georgia and Sacramento, California. The specific methods listed in **Table 1** and SOPs that will be utilized by the laboratories for sample analysis are presented in **Table 5**. The individual analytes to be tested for each method are presented in **Tables 2A** through **2E**. The analytes for each method were selected based on the Target Analyte List (TAL) for metals and the Target Compound List (TCL) for VOCs, SVOCs and Pesticides. Some analyte groups have been added to these lists based on historical data (e.g., herbicides, dioxins and PCBs). **Table 3** presents the specific QC samples to be taken for each analysis on a matrix specific basis.

### **7.1 FIELD ANALYTICAL PROCEDURES**

The standardization and QA information for field measurements of organic vapors, on-site dust concentrations and potentially explosive atmospheres are described in Chapter 6 of this QAPP. A copy of the Health and Safety Plan and FSP have been submitted with the QAPP to expedite review and approval of these methods. Where appropriate, the methods to be used for these measurements are listed in **Table 1**.

### **7.2 LABORATORY ANALYTICAL PROCEDURES**

For this QAPP, Severn Trent Laboratories will follow USEPA Methods listed in **Table 1** and the laboratories SOPs listed in **Table 5**.

The accuracy and precision of the analytical data generated by the laboratory will be determined through the analysis of duplicate samples, spiked samples, reference standard samples, laboratory control samples, and field and laboratory blank samples analyzed along with each set of environmental samples, where applicable.

Interferences will be identified and documented. When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified detection limits. Samples may be diluted only if target or nontarget analytes generate responses in excess of the linear range of the instrument. The Laboratory QAO will document in the case narrative that the laboratory demonstrates good analytical practices in order to achieve the specified detection limits.

Standards and reference materials will be analyzed to determine analyte concentrations for comparison with expected concentrations to provide a measure of accuracy of the methods. For

## **SECTION SEVEN**

### **Analytical Procedures**

organic analyses, the accuracy of the method will be determined by spiking the sample matrix with analytes and surrogates. Percent recoveries of the spikes will be calculated and compared with control limits. A measure of precision will be obtained through the RPD between matrix spikes and matrix spike duplicates. Sampling precision will be evaluated based on the RPD of duplicate field samples. RPDs will be compared to established control limits.

The generated data will be input into the laboratory's database management system. Complete descriptions of analytical procedures to be used in the laboratory are described in the SOPs and in the laboratory's Quality Assurance Manual (QAM) as listed in **Table 5**.

#### **7.2.1 List of Project Target Compounds and Laboratory Detection Limits**

**Tables 2A** through **2E** list the project target compounds, laboratory PQLs, and MDLs for samples to be used as reference during this investigation. Actual reporting limits may be higher in some samples, for example due to dilutions caused by matrix interference or high concentrations of target analytes.

#### **7.2.2 List of Associated QC Samples**

Section 3.7 of this QAPP and **Table 3** contain a listing of the associated QC samples for analytes and matrices.

## SECTION EIGHT

### Internal Quality Control Checks

The overall effectiveness of a quality control program depends upon operating in the field and laboratory according to a program that systematically ensures the precision and accuracy of analyses by detecting errors and preventing their recurrence or measuring the degree of error inherent in the methods applied. This section describes specific quality control checks to be addressed for both field and laboratory analyses in order to comply with the requirements of the FSP.

#### 8.1 FIELD QUALITY CONTROL CHECKS

QC procedures for organic vapors, on-site dust concentrations and potentially explosive atmosphere will include calibrating the instruments as described in Chapter 6 of this QAPP, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple readings on a single sample or reference standard. The QC information for field equipment is stated in Chapter 6 of this QAPP. Section 3.7 of this QAPP discusses the QC samples (including trip blank, equipment blank, MS/MSD, spike duplicate, and field duplicate) that will be collected during the field investigation. **Table 3** lists the environmental and corresponding QC samples to be collected by analyses and matrix type.

Field sampling crews will be under direct supervision of the field sampling leader. Bound notebooks and appropriate data sheets will be used to document the collection of samples and data so that an individual sample or data set can be traced back to its point of origin, sampler, and type of sampling equipment. Sampling will be performed according to the methods provided in the FSP and this QAPP.

Assessment of field sampling precision and bias will be made by collecting field duplicates and field blanks for laboratory analysis.

#### 8.2 LABORATORY QUALITY CONTROL CHECKS

**Tables 4A** through **4F** summarize the laboratory QC requirements, frequency, control limits, and laboratory corrective actions for each analytical method. In addition, the specific SOPs, as listed in **Table 5**, provide a description of the specific QC requirements.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria, and perform data validation. Samples analyzed in nonconformance with the QC criteria

## **SECTION EIGHT**

### **Internal Quality Control Checks**

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will be reanalyzed by the laboratory.

A brief description of laboratory QA/QC analyses for organics and inorganics is contained in the following subsections.

#### **8.2.1 Calibration**

Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis, and calibration verification and performance checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.

#### **8.2.2 Blanks**

Several types of blanks will be analyzed by the laboratory. Corrective action procedures will be implemented and documented for blank analyses if target compounds are detected at concentrations greater than the acceptable criteria. The criteria for evaluation of blanks apply to any blank associated with a group of samples. If problems with a blank exist, data associated with the project must be carefully evaluated to establish whether or not there is an inherent variability in the data for the project, or if the problem is an isolated occurrence not affecting other data.

A reagent blank consists of organic-free distilled water and any reagents added to a sample during analysis only, or straight solvent. This type of sample is analyzed to evaluate whether contamination is occurring during the analysis of the sample. A reagent blank is usually analyzed following highly contaminated samples to assess the potential for cross-contamination during analysis.

A method blank is organic-free water which undergoes the preparation procedures applied to a sample. These samples are analyzed to examine whether sample preparation and analysis techniques result in sample contamination. The laboratory will prepare and analyze a method blank with each group of twenty samples of similar matrix that are analyzed at the same time or one method blank per each 12-hour analytical sequence for GC/MS analysis.

## **SECTION EIGHT**

### **Internal Quality Control Checks**

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Field and trip blanks will also be collected and submitted for laboratory analysis, where appropriate. Field and trip blanks will be handled in the same manner as environmental samples. Field and trip blanks are analyzed to assess contamination introduced during field sampling procedures and sample shipment, respectively.

#### **8.2.3 Internal Standards Performance**

Internal standards, which are compounds not found in environmental samples, will be spiked into blanks, samples, MS/MSDs, and LCSs at the time of sample preparation. Internal standards for polychlorinated dibenzodioxin (PCDD) and polychlorinated dibenzofuran (PCDF) analyses are used to quantitate target compounds and to correct for variability of sample preparation, cleanup, and analysis with respect to individual sample matrices. Internal standards must meet retention time and performance criteria specified in the analytical method or the sample will be reanalyzed.

#### **8.2.4 Recovery Standard**

Recovery standards consist of two labeled PCDDs and PCDFs which are spiked into environmental samples, blanks, and QC samples prior to sample injection for PCDF and PCDD analyses. Recovery standards are used to monitor instrument performance by evaluating retention time shifts and are used to quantify results of internal standards.

#### **8.2.5 Surrogate Recovery**

Accuracy and matrix biases for individual samples are monitored for organic analyses using surrogate additions. Surrogates are compounds similar in nature to the target analytes which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective.

## **SECTION EIGHT**

### **Internal Quality Control Checks**

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#### **8.2.6 Laboratory Control Sample Analyses**

LCSs are standard solutions that consist of known concentrations of the target analytes spiked into laboratory organic-free distilled water or clean sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with all target analytes. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze an LCS with each group of twenty samples of similar matrix that are analyzed at the same time or each 12-hour analytical sequence period for GC/MS analysis. Percent-recoveries will be compared to laboratory control limits to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

#### **8.2.7 MS/MSD/Spike Duplicate Samples**

MS/MSD and spike duplicate analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix. Whenever possible, MS/MSD and spike duplicate samples will be prepared and analyzed within the same batch as the environmental samples. MS/MSD and spike duplicate samples will be spiked at the laboratory with all target analytes. MS/MSD and spike duplicate data are generated to determine long-term precision and accuracy of the analytical method with respect to sample matrices.

#### **8.2.8 Laboratory Duplicate or Matrix Spike Duplicate Samples**

Laboratory duplicate or MSD analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix for inorganic analyses. Whenever possible, laboratory duplicate or MSD samples will be prepared and analyzed within the same batch as the environmental samples. Laboratory duplicate or MSD data are generated to determine long-term precision of the analytical method with respect to sample matrices.

#### **8.2.9 Compound Identification and Quantitation**

The objective of the qualitative criteria is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present). The



## **SECTION EIGHT**

### **Internal Quality Control Checks**

identification criteria can be applied much more easily in detecting false positives than false negatives. Negatives, or non-detected compounds, on the other hand represent an absence of data and are, therefore, much more difficult to assess. The objective for quantitative requirements is to maximize the accuracy of data and sensitivity of the instrument. Samples will be analyzed undiluted when technically feasible (due to carryover or instrument contamination) to maximize sensitivity and to meet QAPP guidance criteria. Samples must be reanalyzed at the appropriate dilution when concentrations exceed the linear calibration range to maximize accuracy.

#### **8.2.10 Control Limits**

Laboratory control limits are established separately for each matrix type for each type of analysis. Laboratory control limits can be considered action limits. These limits are defined as  $\pm$  three standard deviations of the mean and correspond to 99.7% confidence limits of a normal distribution curve. The laboratory will establish control limits for each analyte of concern using a minimum of twenty data points. Laboratory control limits may change since limits are minimally updated on a yearly basis with the addition of new data points.

The laboratory control limits used to assess data for this program will be summarized by the laboratory in the analytical report.

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

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For data to be scientifically valid, legally defensible, and comparable, valid procedures must be used to prepare these data. The following describes the data reduction, validation, and reporting procedures to be used for the Laboratory data.

Data reduction is the process of converting raw analytical data to final results in proper reporting units. Data reporting is the detailed description of the data deliverables used to completely document the analysis, calibration, quality control measures, and calculations. Data validation is the process of qualifying analytical/measurement data on the performance of the field and laboratory quality control measures incorporated into the sampling and analysis procedures.

Specific laboratory procedures and instrumentation can be found in the QAM and/or SOPs listed in **Table 5**. The data production and reporting procedures described below will be employed at the laboratory.

All data generated through field activities and analyzed by the laboratory shall be reduced by the laboratory, reported to URS, validated, and then reported to USEPA Region V.

#### **9.1 DATA REDUCTION**

##### **9.1.1 Field Data Reduction Procedures**

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory. Only direct reading instrumentation will be employed in the field. The use of PIDs, RAMs and explosimeters will generate some measurements directly from the meters following calibration by the respective manufacturer's recommendations. Such data will be written into field notebooks immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original entry. Later, when the results forms are filled out, the URS Field Team Leader will proof the forms to assess whether transcription errors have been made.

##### **9.1.2 Laboratory Data Reduction Procedures**

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify that compound identification and quantitation adhere to method requirements. The laboratory will be responsible for maintaining a listing of computer-based data reduction

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

programs which it uses for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (for example, preparation weights, volumes, and reagents). Instrument injection logs or bench sheets will also be maintained for each instrument. The equations that will be used in reducing data are those listed in the USEPA methods. Analytical results for soil samples shall be calculated and reported on a dry weight basis.

QC data will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QAO for review. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Laboratory QAO or Laboratory PM approves these data, they are considered ready for data validation.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

Analytical results are generally entered into the laboratory computer system by the analyst, independently reviewed by another analyst or supervisor experienced in the method, and approved by the Laboratory QAO or Laboratory PM. The following are requirements that are generally examined as part of this review:

- Initial calibration criteria were met. Standards in the calibration curve covered the expected concentration ranges of the samples
- Initial and continuing calibrations met the acceptance criteria defined in the method standard procedure
- Sample results fell within the range of the standard curve
- For GC/MS methods requiring internal standards, retention times and area responses were evaluated against limits established by the daily calibration
- Method blanks were processed with each analytical batch and no detectable levels of contamination were identified (with the possible exception of common laboratory contaminants)

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

- MS/MSDs were performed at the required frequency and recoveries were within acceptable control limits
- Duplicate analyses were performed at the required frequency and results were within the advisory control limits
- LCS analyses were performed with each analytical batch and the results obtained were within control limits
- For organic compound analyses, surrogate spike recoveries were within control limits
- Compounds identified by GC/MS have been manually rechecked by comparison with the data system library for both target compounds and tentatively identified compounds. Retention times and ratios of fragmentation were verified
- Calculations have been accurately performed
- Reporting units are correct
- Data for the analysis provide a complete audit trail
- Reported detection limits comply with data quality indicator requirements.

The analyst's supervisor will check a minimum of 10% of the data back to raw data in the secondary review, (or as outlined in the laboratory QAPP). When required analyses on the samples in a project are complete, entered, and reviewed, a report will be generated.

The report will be forwarded to the Laboratory QAO for review. The report will then be reviewed for the following items (at a minimum):

- QC data will be reviewed to identify whether or not internal specification and contract requirements have been met
- Non-conformance reports, if any, will be reviewed for completion of corrective actions and their impact of results. Non-compliance and corrective action procedures will be documented in the case narrative in the final report.

The report requires the signature of the Laboratory QAO or Laboratory PM. Electronic data are copied onto computer tape, inventoried, and stored off-site in a secure facility, or within locked cabinets on-site. This data archive system is maintained minimally for ten years.

## SECTION NINE

## Data Reduction, Validation, Reporting, and Data Management

### 9.2 DATA VALIDATION

Data validation procedures shall be performed for both field and laboratory operations.

#### 9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors on the part of field crew members and review of field notebooks. This task will be the responsibility of the URS Field Team Leader.

#### 9.2.2 Procedures to Validate Laboratory Data

Data validation will be performed by URS in accordance with QA/QC criteria established in this QAPP and the analytical methods for 100% of the analytical data. A Level II validation will be performed for approximately 80% of the data, and a Level IV validation will be performed for approximately 20% of the data. Excursions from QA/QC criteria will be qualified based on guidance provided in the following documents or the most recent USEPA data validation guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review*. USEPA 540/R-00/006 (USEPA, 2001)
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. USEPA 540/R-01/008 (USEPA, 2002)
- *USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review*. USEPA 540/R-02/003 (USEPA, 2002)

Herbicides will also be reviewed using guidance presented in National Functional Guidelines for Low Concentration Organic Review (USEPA 2001); however, since no specific criteria are presented in the guidance document, the data will be reviewed following the criteria established in Method 8151 and using the QC limits provided in this QAPP.

The analytical data from each method and matrix will be reviewed for the QC parameters as presented in the following section. Data validators will recalculate 20% of the laboratory sample calculations using raw data when verifying sample results. In addition, data validators will review 20% of the raw data to verify that compound identification was performed correctly and transcription errors are not present.

## SECTION NINE

## Data Reduction, Validation, Reporting, and Data Management

Data quality will be evaluated using method or laboratory control limits. Any control limits outside of the acceptable range shall be identified and reported. Sample data will be qualified based on excursions from method or laboratory control limits. Data not within control limits require corrective action by the laboratory. Data validators will check corrective actions and results of reanalysis and document these events in the validation report.

Minor deficiencies in the data generation process noted in the data validation will result in approximation of sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical but not its assigned identity. Major deficiencies noted in the data, validation will result in the rejection of sample results. Rejected data would be considered unusable for quantitative or qualitative purposes. Data qualifiers may include the following:

- U Indicates that the compound was analyzed for, but was not detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture. This qualifier is also used to signify that the detection limit of an analyte was raised as a result of analytes detected in laboratory and/or field blank samples.
- J Indicates that the detected sample result should be considered approximate based on excursions from QA/QC criteria.
- UJ Indicates that the detection limit for the analyte in this sample should be considered approximate based on excursions from QA/QC criteria.
- R Indicates that the previously reported detection limit or sample result has been rejected due to a major excursion from QA/QC criteria, for example percent recoveries of less than ten percent. The data should not be used for qualitative or quantitative purposes.

The following method specific QA/QC parameters will be evaluated (at a minimum) during the data validation, where applicable.

Analyses for VOCs and SVOCs (where applicable)

- Holding times, sample preservation, and percent solids
- Dilutions
- GC/MS tuning criteria (Level IV validation only)

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

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- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- Surrogate recovery
- MS/MSD analysis
- Field duplicate analysis
- Laboratory Control Sample (LCS) analysis
- Internal standards performance (Level IV validation only)
- Compound identification and quantitation (Level IV validation only)
- Reported detection limits
- System performance (Level IV validation only)
- Documentation completeness
- Overall assessment.

Analyses for pesticides, PCBs, and herbicides (where applicable):

- Holding times, sample preservation, and percent solids
- Dilutions
- GC performance (Level IV validation only)
- Analytical sequence (Level IV validation only)
- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- Surrogate recovery
- MS/MSD analysis
- Field duplicate analysis
- LCS and MS blank analysis

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

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- Retention time windows (Level IV validation only)
- Analyte identification, quantitation, and reported detection limits (Level IV validation only)
- Cleanup efficiency verification (Level IV validation only)
- Confirmation analysis (Level IV validation only)
- System performance (Level IV validation only)
- Documentation completeness
- Overall assessment.

Analysis for metals, mercury, and cyanide analyses (where applicable):

- Holding times, sample preservation, and percent solids
- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- ICP interference check sample analysis (Level IV validation only)
- Spike duplicate analysis
- Field duplicate analysis LCS analysis
- Laboratory duplicate analysis
- ICP serial dilution analysis
- Furnace atomic absorption analysis (Level IV validation only)
- Verification of instrument parameters (Level IV validation only)
- Instrument detection limits
- Linear ranges (Level IV validation only)
- Analyte quantitation and reported detection limits (Level IV validation only)



## SECTION NINE

## Data Reduction, Validation, Reporting, and Data Management

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- Documentation completeness
- Overall assessment.

Analysis for PCDDs and PCDFs analyses (where applicable):

- Holding times, sample preservation, and percent solids
- GC/MS tuning criteria (Level IV validation only)
- Column performance check standard analysis (Level IV validation only)
- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- Internal standard criteria (Level IV validation only)
- Recovery standard criteria
- MS/MSD analysis
- Field duplicate analysis
- Compound identification and quantitation (Level IV validation only)
- Confirmation analysis (Level IV validation only)
- System performance (Level IV validation only)
- Documentation completeness
- Overall assessment.

The laboratories will be conducting analyses on samples in accordance with methods listed in **Table 1** and the laboratory's SOPs. Data generated by the laboratory will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by Severn Trent Laboratories as well as the URS data validation results.

### 9.3 DATA REPORTING

Data reporting procedures shall be carried out for field and laboratory operations as indicated below.

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

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#### **9.3.1 Field Data Reporting**

Field data reporting shall be conducted principally through the transmission of field logs containing tabulated results of all measurements made in the field, and documentation of all field calibration activities.

#### **9.3.2 Laboratory Data Reporting**

Data generated through field activities and analyzed by the laboratory shall be reduced by the laboratory, reported to URS, validated, then reported to USEPA Region V.

The Laboratory QAO, Laboratory OM, and Laboratory PM must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. The data packages provided by the laboratory will provide information so that a complete data validation can be performed on the data generated for this project.

The data report forms will be sequentially numbered. The laboratory will provide data reports that will include the following information (at a minimum):

- Case narrative report containing a summary of the samples collected, problems with sample receipt, methods employed, QA/QC excursions, and corrective action procedures
- Cross-reference table of sample identifications, laboratory sample identifications, sample matrix, analysis required and performed, date of sample collection, and date of sample receipt
- Case file containing documentation of cooler temperature and preservation checks performed
- Copies of completed chain-of-custody records
- Internal laboratory chain-of-custody records
- Analytical results of environmental samples, field duplicates, equipment blanks, and trip blanks with appropriate reporting limits
- Surrogate recovery results with appropriate laboratory control limits
- Batch-specific QA/QC results for laboratory method blanks, MS/MSDs, and LCSs with appropriate laboratory control limits

## **SECTION NINE**

### **Data Reduction, Validation, Reporting, and Data Management**

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- GC/MS tuning data
- Initial and continuing calibration data summarized
- GC/MS internal standard summary forms
- Metals ICP quality control data summarized
- Summary table of MDLs and laboratory reporting limits
- Sample preparation bench sheets, digestion logs, and injection logs
- Appropriate raw instrument outputs for samples, blanks, QA/QC samples, and calibration standards
- Sample data
- Extraction log information
- Corrective action logs.

Tentatively identified compounds will not be reported for this project.

Standard preparation logs, use logs, and MDL studies will be made available by the laboratory upon request.

Review and cross-checking procedures will be as described in the laboratory SOPs and will ensure that the raw data and calculation results are properly, completely, and accurately transferred to the laboratory reporting format. In addition to the hardcopy version of the analytical data packages, the laboratory will provide electronic deliverables.

#### **9.4 DATA MANAGEMENT**

Data will be managed in a relational database management system (DBMS). Laboratory analytical data will be provided in electronic format for direct upload into the DBMS. Associated field data will be entered into the DBMS by hand, as appropriate.

The DBMS will then be used to provide custom queries and reports to support data validation, data analysis, and report preparation.

## SECTION TEN

## Performance and Systems Audits

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The performance audit is an independent check to evaluate the quality of data being generated. The system audit is an on-site review and evaluation of the laboratories, instrumentation, quality control practices, data validation, and documentation procedures.

At the discretion of the URS Project Officer, performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analyses are performed in accordance with the procedures established in the FSP and this QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

If requested, the internal audits will be performed by the URS QAO. The external audits will be performed by USEPA Region V.

### 10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

#### 10.1.1 Internal Field Audits

*Internal field audit responsibilities.* Internal audits of field activities including sampling and field measurements will be conducted by the URS QAO.

*Internal field audit frequency.* These audits will verify that established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the site sample collection activities and as required by the URS Project Officer thereafter.

*Internal field audit procedures.* The audits will include examination of field sampling records, field instrumentation operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, and other elements of the field program. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the FSP. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The areas of concern in a field audit include:

- Sampling procedures
- Decontamination of sampling equipment, if applicable
- Chain-of-custody procedures

## SECTION TEN

## Performance and Systems Audits

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- SOPs
- Proper documentation in field notebooks.

### 10.1.2 External Field Audits

*External field audit responsibilities.* External field audits may be conducted by USEPA Region V.

*External field audit frequency.* External field audits may be conducted at any time during the field operations. These audits may or may not be announced and are at the discretion of USEPA Region V.

*Overview of the external field audit process.* External field audits will be conducted according to the field activity information presented in this QAPP.

## 10.2 LABORATORY SYSTEM AUDITS

### 10.2.1 Internal Laboratory Audits

*Internal laboratory audit responsibilities.* The internal laboratory audit will be conducted by the URS QAO.

*Internal laboratory audit frequency.* The internal laboratory system audits may be conducted on an annual basis.

*Internal laboratory audit procedures.* The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation, and analysis, instrumentation operating records, etc. The URS QAO will evaluate the analytical results to ensure the laboratory maintains acceptable QC performance.

### 10.2.2 External Laboratory Audits

*External laboratory audit responsibilities.* An external audit may be conducted by USEPA Region V.

*External laboratory audit frequency.* An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of USEPA Region V.

## **SECTION TEN**

### **Performance and Systems Audits**

*Overview of the external laboratory audit process.* External laboratory audits will include review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

The specific parameters to be evaluated (at a minimum) will include:

- Data comparability
- Calibration and quantitation
- QC execution
- Out-of-control events
- SOPs
- Sample management
- Record keeping
- Instrument calibration records
- Other analytical records
- QC records
- Corrective action reports
- Maintenance logs
- Data review
- Limits of detection
- QC limits
- Analytical methods.

## **SECTION ELEVEN**

### **Preventive Maintenance**

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#### **11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE**

The anticipated field equipment for this project includes a PID, a RAM, and an explosimeter. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented in the field notebooks. Critical spare parts such as batteries will be kept on-site to reduce downtime.

#### **11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE**

As part of their QA/QC programs, routine preventive maintenance programs are conducted by Severn Trent Laboratories to minimize the occurrence of instrument failure and other system malfunctions. Severn Trent Laboratories perform routine scheduled maintenance and coordinate with the vendor for the repair of all instruments. Laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument maintenance logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives.

## **SECTION TWELVE**

### **Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness**

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The procedures to assess the quality of data generated in the laboratory may include, but not be limited to, the following:

- Determination of analytical precision per method
- Determination of analytical accuracy per method
- Determination of analytical completeness.

The quality of data will be determined through evaluation of the appropriate QC measurements according to the specific analytical method used.

Precision and accuracy will be assessed utilizing method limits or control charts, where applicable. Control charts will consist of line graphs which provide a continuous graphic representation of the state of each analytical procedure. The standard deviation of the mean of the QC measurement is calculated, and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Acceptable data are realized when results fall between the lower and upper warning limits. If the QC value falls between the control limit and the warning limit, the analysis should be scrutinized as possibly out-of-control.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte and by analyzing reference materials with known concentrations, where applicable. The spiking levels will be selected to reflect the concentration range of interest. Percent recoveries of the spikes and reference materials will be calculated and compared to the established limits. The precision of the methods will be determined by the analysis of MS and laboratory and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates. RPD calculations will be compared to the established limits.

The definitions and equations used for the assessment of data quality are discussed below.

#### **12.1 ACCURACY ASSESSMENT**

Accuracy is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally, the term accuracy is used synonymously with percent recovery. It describes either the



## **SECTION TWELVE**

### **Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness**

recovery of a synthetic standard of known value, or the recovery of known amount of analyte (spike) added to a sample of known value. The %R or accuracy can be calculated by using:

standards:  $\%R = (\text{observed value}/\text{true value}) \times 100$

spikes:  $\%R = (\text{conc. spike} + \text{sample conc.}) - (\text{sample conc.} \times 100)/\text{conc. spike}$

#### **12.2 PRECISION ASSESSMENT**

Precision refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. It is usually expressed in terms of the percent difference (%D) or RPD. The %D is calculated by using:

$\%D = (\text{larger SR} - \text{smaller SR} \times 100) / \text{smaller SR}$

where SR is the sample result. The RPD is calculated by using:

$RPD = (|OSR - DSR| \times 100) / ((OSR + DSR)/2)$

where OSR is the original sample result and DSR is the duplicate sample result.

#### **12.3 COMPLETENESS ASSESSMENT**

The completeness is the ratio of the number of valid sample results to the total number of samples analyzed for a specific matrix and/or analysis. It is calculated by using the following equation:

$\text{Completeness} = \text{number of valid measurements} / \text{number of measurements planned} \times 100.$

## **SECTION THIRTEEN**

### **Corrective Action**

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out-of-control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective actions proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the URS PM, or the URS Field Team Leader. If immediate corrective action is required, approvals secured by telephone from the URS PM should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the URS PM, who in turn will notify the URS PO. Implementation of a corrective action will be confirmed in writing through the same channels. Nonconformance with the established quality control procedures in this QAPP or FSP will be identified and corrected in accordance with this QAPP.

#### **13.1 FIELD CORRECTIVE ACTION**

Corrective action in the field could be needed when the sample network is changed (i.e., more or less samples, sampling location changes, and related modifications) or sampling procedures and/or field analytical procedures require modification due to unexpected conditions. Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformities or suspected deficiencies of any activity or issued document by reporting the situation to the URS Field Team Leader. The URS Field Team Leader will be responsible for assessing the suspected problems in consultation with the URS PM and assessing the potential for the situation to impact the quality of the data. If the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the URS PM.

The URS PM will be responsible for seeing that corrective action for nonconformance are initiated by:

- Evaluating reported nonconformities
- Controlling additional work on nonconforming items
- Establishing disposition or action to be taken

## **SECTION THIRTEEN**

### **Corrective Action**

- Maintaining a log of nonconformities
- Verifying nonconformance reports and corrective actions taken
- Verifying nonconformance reports are included in the final site documentation in project files.

If appropriate, the URS Field Team Leader will verify that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include:

- Repeat the measurement to check the error
- Check for all proper adjustments for ambient conditions such as temperature
- Check the batteries
- Re-calibration
- Check the calibration
- Replace the instrument or measurement devices.
- Stop work (if necessary).

The URS Field Team Leader is responsible for site activities. In this role, the URS Field Team Leader at times is required to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the URS Field Team Leader of the anticipated change and implements the necessary changes after obtaining the approval of the URS Field Team Leader. The change in the program will be documented on the field change request (FCR) that will be signed by the initiators and the URS Field Team Leader. The FCR for each document will be numbered serially as required. The FCR shall be attached to the file copy of the affected document. The URS Field Team Leader must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to ascertain the significance of any departure from program practices and action taken.

The URS Field Team Leader is responsible for the controlling, tracking, and implementing the identified changes. Reports on changes will be distributed to all affected parties, including USEPA Region V.

## SECTION THIRTEEN

### Corrective Action

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Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The URS QAO will identify deficiencies and recommend corrective action to the URS PM. Implementation of corrective actions will be performed by the URS Field Team Leader and the field team. Corrective action will be documented in the quality assurance report to the project management.

Corrective actions will be implemented and documented in the field notebook. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by USEPA Region V.

### 13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analysis. A number of conditions, such as broken sample containers, multiple phases, low or high pH readings, or potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and section leaders, it may be necessary for the Laboratory QAO to approve the implementation of corrective action. **Tables 4A through 4F** specify conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples or automatic reinjection or reanalysis of samples.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- There are unusual changes in the detection limits
- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples

## **SECTION THIRTEEN**

### **Corrective Action**

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- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter is referred to the Laboratory OM, Laboratory PM, and Laboratory QAO for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

**Tables 4A through 4F** describe the quality control requirements and the corrective actions for each type of analysis required for this FSP.

These corrective actions are performed prior to release of the data from the laboratory. The corrective actions will be documented in both the laboratory corrective action log and the case narrative. If corrective action does not rectify the situation, the laboratory will contact the URS QAO.

### **13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT**

The URS QAO and Laboratory QAO may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection or reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team or whether the data to be collected are necessary to meet the required quality assurance objectives. When the URS QAO or Laboratory QAO identifies a corrective action situation, it is the URS PM who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. Corrective actions of this type will be documented by the URS QAO and the Laboratory QAO.

## **SECTIONFOURTEEN**

### **Quality Assurance Reports to Management**

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The deliverables associated with the tasks identified in the FSP and periodic progress reports will contain a separate QA section in which data quality information collected during the task is summarized. Those reports will be the responsibility of the URS PM and will include the URS QAO and Laboratory QAO report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

#### **14.1 CONTENTS OF PROJECT QA REPORTS**

The QA reports will contain on a routine basis results of field and laboratory audits, information generated during the past month reflecting the achievement of specific data quality objectives, and a summary of corrective action that was implemented and its immediate results on the project. The status of the project with respect to the project schedule will be established. Whenever necessary, changes in key personnel and anticipated problems in the field or the laboratory for the coming month that could bear on data quality, along with proposed solutions, will be reported. Detailed references to QAPP modifications will also be highlighted. QA reports will be prepared in written format by the URS PM. In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the project organization section of this QAPP. However, these events and their resolution will be addressed thoroughly in the next issue of the monthly QA report.

#### **14.2 FREQUENCY OF QA REPORTS**

The QA reports will be prepared on a monthly basis. The reports will continue without interruption until the project has been completed.

#### **14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS**

Individuals identified in Chapter 2 of this QAPP will receive copies of the monthly QA reports.

## SECTION FIFTEEN

## References

- Solutia, 2000. Description of Current Conditions Report, August 1, 2000. Prepared by URS Corporation.
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**Tables**

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**TABLE 1**  
**ANALYTICAL METHODS FOR PARAMETERS**

Parameter	Sample Media	Analytical Method	References	Laboratory Performing Analysis
VOCs	soil	EPA Method 8260B	1	Severn Trent at Savannah, Georgia
SVOCs	soil	EPA Method 8270C	1	Severn Trent at Savannah, Georgia
Pesticides	soil	EPA Method 8081A	1	Severn Trent at Savannah, Georgia
Herbicides	soil	EPA Method 8151A	1	Severn Trent at Savannah, Georgia
PCBs	soil	EPA Method 680	2	Severn Trent at Savannah, Georgia
Dioxins	soil	EPA Method 8280A	1	Severn Trent at Sacramento, California
Metals	soil	EPA Method 6010B	1	Severn Trent at Savannah, Georgia

**Notes:**

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

- 1 USEPA. 1996a. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846*, 3<sup>rd</sup> Edition. Washington D.C.
- 2 USEPA. 1985. *Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Gas Spectrometry, Physical and Chemical Methods Branch*, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.

**TABLE 2A**  
**LABORATORING CONTROL LIMITS AND DETECTION LIMITS**



STL Savannah

**8260 Table - Soil**

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
1,1,1-Trichloroethane	8260(5035)	41-134	<=54	0.33	5	1,200,000 (b)
1,1,2,2-Tetrachloroethane	8260(5035)	49-144	<=28	0.37	5	930 (a)
1,1,2-Trichloroethane	8260(5035)	34-148	<=27	0.4	5	1,800,000 (b)
1,1-Dichloroethane	8260(5035)	51-129	<=38	0.38	5	130,000 (b)
1,1-Dichloroethene (MS)	8260(5035)	40-164	<=46	0.4	5	300,000 (b)
1,2-Dichloroethenes (total)	8260(5035)	37-142	<=56	0.88	10	3,100,000 (b)
1,2-Dichloroethane	8260(5035)	49-136	<=25	0.3	5	700 (b)
1,2-Dichloropropane	8260(5035)	52-124	<=27	0.43	5	500 (b)
2-Butanone (MEK)	8260(5035)	45-154	<=39	1.1	25	27,000,000 (a)
2-Hexanone	8260(5035)	45-127	<=32	1.2	25	2,800,000 (a,c)
4-Methyl-2-pentanone (MIBK)	8260(5035)	34-159	<=37	0.56	25	2,800,000 (a)
Acetone	8260(5035)	43-154	<=28	5	50	100,000,000 (b)
Benzene (MS)	8260(5035)	49-142	<=42	0.4	5	1,600 (b)
Bromodichloromethane	8260(5035)	32-149	<=33	0.16	5	92,000 (b)
Bromoform	8260(5035)	41-138	<=24	0.36	5	100,000 (b)
Bromomethane	8260(5035)	23-173	<=79	1.2	10	3,900 (b)
Carbon disulfide	8260(5035)	40-135	<=68	0.41	5	9,000 (b)
Carbon tetrachloride	8260(5035)	40-135	<=59	0.17	5	640 (b)
Chlorobenzene (MS)	8260(5035)	66-135	<=34	0.19	5	1,300 (b)
Chloroethane	8260(5035)	30-135	<=51	0.71	10	6,500 (a)
Chloroform	8260(5035)	50-133	<=38	0.36	5	540 (b)
Chloromethane	8260(5035)	32-142	<=53	0.39	10	2,600 (a)
cis-1,3-Dichloropropene	8260(5035)	40-133	<=34	0.27	5	390 (b)
Dibromochloromethane	8260(5035)	47-135	<=22	0.16	5	1,300,000 (b)
Ethylbenzene	8260(5035)	51-135	<=44	0.13	5	58,000 (b)
Methylene chloride	8260(5035)	44-142	<=32	2.2	5	24,000 (b)
Styrene	8260(5035)	43-140	<=45	0.2	5	430,000 (b)
Tetrachloroethene	8260(5035)	71-146	<=44	0.26	5	20,000 (b)
Toluene (MS)	8260(5035)	38-158	<=32	0.34	5	42,000 (b)
trans-1,3-Dichloropropene	8260(5035)	45-131	<=50	0.2	5	390 (b)
Trichloroethene (MS)	8260(5035)	51-146	<=34	0.26	5	8,900 (b)
Vinyl chloride	8260(5035)	33-142	<=65	0.3	10	1,100 (b)
Xylenes (total)	8260(5035)	37-133	<=43	0.57	10	320,000 (b)
Isopropylbenzene	8260(5035ext)	38-148	<=39	3.8	5.0	2,000,000 (a)
Trichlorofluoromethane	8260(5035ext)	32-138	<=30	2.0	5.0	2,000,000 (a)
<b>Surrogates</b>						
Dibromofluoromethane	8260(5035)	58-142	NA	NA	NA	
Dibromofluoromethane	8260(5035ext)	58-142	NA	NA	NA	
p-Bromofluorobenzene	8260(5035)	63-135	NA	NA	NA	
p-Bromofluorobenzene	8260(5035ext)	63-135	NA	NA	NA	
Toluene-d8	8260(5035)	64-136	NA	NA	NA	
Toluene-d8	8260(5035ext)	64-136	NA	NA	NA	

(a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.

(b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/Inhalation Scenario. IEPA 2002.

(c) Due to structural similarities the value for 4-Methyl-2-pentanone was used.

**TABLE 2B**  
**LABORATORY CONTROL LIMITS AND DETECTION LIMITS**



STL Savannah

**8270 Table - Soil**

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
1,2,4-Trichlorobenzene (MS)	8270(3550)	10-112	<=22	17	330	920,000 (b)
1,2-Dichlorobenzene	8270(3550)	25-115	<=24	18	330	310,000 (b)
1,3-Dichlorobenzene	8270(3550)	26-108	<=28	17	330	310,000 (b,c)
1,4-Dichlorobenzene (MS)	8270(3550)	10-105	<=31	17	330	340,000 (b)
2,4,5-Trichlorophenol	8270(3550)	25-130	<=36	23	330	200,000X10 <sup>3</sup> (b)
2,4,6-Trichlorophenol	8270(3550)	41-130	<=30	20	330	390,000 (b)
2,4-Dichlorophenol	8270(3550)	32-130	<=60	22	330	610,000 (b)
2,4-Dimethylphenol	8270(3550)	33-84	<=54	22	330	41,000X10 <sup>3</sup> (b)
2,4-Dinitrophenol	8270(3550)	10-125	<=84	160	1700	410,000 (b)
2,4-Dinitrotoluene (MS)	8270(3550)	11-120	<=37	18	330	8,400 (b)
2,6-Dinitrotoluene	8270(3550)	10-112	<=45	40	330	8,400 (b)
2-Chloronaphthalene	8270(3550)	39-107	<=47	22	330	23,000X10 <sup>3</sup> (a)
2-Chlorophenol (MS)	8270(3550)	15-111	<=38	21	330	10,000,000 (b)
2-Methyl phenol (o-Cresol)	8270(3550)	33-108	<=53	25	330	100,000,000 (b)
2-Methylnaphthalene	8270(3550)	30-133	<=63	20	330	1,800 (d)
2-Nitroaniline	8270(3550)	17-130	<=48	20	1700	18,000 (a)
2-Nitrophenol	8270(3550)	30-130	<=50	32	330	7,000,000 (e)
3- and 4-Methyl phenol	8270(3550)	24-114	<=42	41	330	100,000,000 (b,f)
3,3'-Dichlorobenzidine	8270(3550)	10-115	<=39	36	660	13,000 (b)
3-Nitroaniline	8270(3550)	14-130	<=28	30	1700	18,000 (a,g)
4,6-Dinitro-2-methylphenol	8270(3550)	10-117	<=57	150	1700	na
4-Bromophenyl phenyl ether	8270(3550)	31-157	<=19	43	330	na
4-Chloro-3-methylphenol (MS)	8270(3550)	24-114	<=32	30	330	na
4-Chloroaniline	8270(3550)	10-130	<=85	24	660	820,000 (b)
4-Chlorophenylphenyl ether	8270(3550)	36-149	<=62	17	330	na
4-Nitroaniline	8270(3550)	10-130	<=55	140	1700	18,000 (a,g)
4-Nitrophenol(MS)	8270(3550)	15-118	<=57	150	1700	7,000,000 (h)
Acenaphthene (MS)	8270(3550)	18-123	<=49	17	330	120,000,000 (b)
Acenaphthylene	8270(3550)	42-119	<=48	36	330	120,000,000 (b,i)
Anthracene	8270(3550)	40-148	<=27	42	330	610,000,000 (b)
Benzo(a)anthracene	8270(3550)	54-137	<=43	17	330	8,000 (b)
Benzo(a)pyrene	8270(3550)	41-142	<=55	18	330	800 (b)
Benzo(b)fluoranthene	8270(3550)	43-134	<=51	22	330	8,000 (b)
Benzo(g,h,i)perylene	8270(3550)	10-148	<=50	17	330	61,000,000 (b,j)
Benzo(k)fluoranthene	8270(3550)	25-182	<=48	20	330	78,000 (b)
Bis(2-chloroethoxy) methane	8270(3550)	34-108	<=52	19	330	na
Bis(2-chloroethyl) ether	8270(3550)	18-122	<=50	25	330	470 (b)
Bis(2-chloroisopropyl) ether	8270(3550)	10-135	<=28	25	330	7,400 (a)
Bis(2-ethylhexyl) phthalate	8270(3550)	47-143	<=22	19	330	410,000 (b)
Butyl benzyl phthalate	8270(3550)	58-122	<=27	18	330	930,000 (b)
Carbazole	8270(3550)	10-158	<=50	36	330	290,000 (b)
Chrysene	8270(3550)	56-133	<=41	17	330	780,000 (b)
Dibenz(a,h)anthracene	8270(3550)	31-129	<=24	41	330	800 (b)
Dibenzofuran	8270(3550)	36-132	<=42	17	330	3,100,000 (a)
Diethylphthalate	8270(3550)	31-130	<=40	22	330	2,000,000 (b)

**TABLE 2B**  
**LABORATORY CONTROL LIMITS AND DETECTION LIMITS**



STL Savannah

**8270 Table - Soil**

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
Dimethylphthalate	8270(3550)	49-130	<=45	17	330	1X10 <sup>8</sup> (a)
Di-n-butylphthalate	8270(3550)	42-161	<=59	28	330	2,300,000 (b)
Di-n-octylphthalate	8270(3550)	22-181	<=43	22	330	4,100,000 (b)
Dinoseb	8270(3550)	10-150	<=100	21	330	620,000 (a)
Fluoranthene	8270(3550)	39-157	<=50	25	330	82,000,000 (b)
Fluorene	8270(3550)	27-151	<=50	24	330	82,000,000 (b)
Hexachlorobenzene	8270(3550)	19-155	<=33	21	330	1,800 (b)
Hexachlorobutadiene	8270(3550)	33-114	<=55	18	330	22,000 (a)
Hexachlorocyclopentadiene	8270(3550)	D-132	<=50	130	330	1,100 (b)
Hexachloroethane	8270(3550)	10-109	<=30	17	330	2,000,000 (b)
Indeno(1,2,3-cd)pyrene	8270(3550)	24-136	<=28	21	330	8,000 (b)
Isophorone	8270(3550)	15-115	<=50	17	330	4,600,000 (b)
Naphthalene	8270(3550)	25-131	<=34	25	330	1,800 (b)
Nitrobenzene	8270(3550)	19-120	<=30	17	330	9,400 (b)
N-Nitrosodiphenylamine	8270(3550)	51-132	<=44	18	330	1,200,000 (b)
N-Nitrosos-di-N-propylamine (MS)	8270(3550)	11-122	<=37	27	330	800 (b)
Pentachlorophenol (MS)	8270(3550)	10-140	<=55	150	1700	24,000 (b)
Phenanthrene	8270(3550)	39-152	<=30	17	330	610,000,000 (b,k)
Phenol (MS)	8270(3550)	13-115	<=39	22	330	120,000,000 (b)
Pyrene (MS)	8270(3550)	10-133	<=42	31	330	61,000,000 (b)
<b>Surrogates</b>						
Phenol-d5	8270(3550)	19-114	NA	NA	NA	
p-Terphenyl-d14	8270(3550)	30-131	NA	NA	NA	
Nitrobenzene-d5	8270(3550)	20-120	NA	NA	NA	
2-Fluorobiphenyl	8270(3550)	30-120	NA	NA	NA	
2-Fluorophenol	8270(3550)	16-113	NA	NA	NA	
2,4,6- Tribromophenol	8270(3550)	23-129	NA	NA	NA	

- (a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.
- (b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/Inhalation Scenario. IEPA 2002.
- (c) Due to structural similarities the value for 1,2-dichlorobenzene was used.
- (d) Due to structural similarities the value for naphthalene was used.
- (e) Due to structural similarities the value for 4-nitrophenol from USEPA Region 9 Preliminary Remediation Goals, 1999 was used.
- (f) Due to structural similarities the value for 2-methylphenol was used.
- (g) Due to structural similarities the value for 2-nitroaniline was used.
- (h) No TACO value available; therefore, USEPA PRGs, 1999, were used.
- (i) No TACO value available; therefore, the value for acenaphthene was used.
- (j) No TACO value available; therefore, the value for pyrene was used.
- (k) Due to structural similarities the value for anthracene was used.

**TABLE 2C**  
**LABORATORY CONTROL LIMITS AND DETECTION LIMITS**

**SEVERN**  
**TRENT**  
**SERVICES**  
STL Savannah

**8081 Table - Soil**

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
Aldrin (MS)	8081	10-144	<=38	0.29	1.7	300 (b)
alpha-BHC	8081	22-101	<=40	0.12	1.7	900 (b)
beta-BHC	8081	12-120	<=40	0.12	1.7	4,000 (b,c)
Gamma-BHC (Lindane) (MS)	8081	12-138	<=37	0.11	1.7	4,000 (b)
delta-BHC	8081	10-142	<=47	0.25	1.7	4,000 (b,c)
alpha Chlordane	8081	45-140	<=40	0.097	1.7	1,600 (b,d)
Gamma Chlordane	8081	11-141	<=40	0.1	1.7	1,600 (b,d)
4,4'-DDD	8081	28-134	<=50	0.34	3.3	24,000 (b)
4,4'-DDE	8081	34-121	<=25	0.3	3.3	17,000 (b)
4,4'-DDT (MS)	8081	29-134	<=26	0.54	3.3	17,000 (b)
Dieldrin (MS)	8081	28-137	<=30	0.26	3.3	400 (b)
Endosulfan I	8081	10-141	<=40	0.12	1.7	1,200,000 (b,e)
Endosulfan II	8081	10-159	<=65	0.39	3.3	1,200,000 (b,e)
Endosulfan sulfate	8081	26-144	<=50	0.34	3.3	1,200,000 (b,e)
Endrin (MS)	8081	33-149	<=32	0.38	3.3	61,000 (b,f)
Endrin aldehyde	8081	10-130	<=86	0.38	3.3	61,000 (b,f)
Endrin ketone	8081	29-112	<=31	0.3	3.3	61,000 (b,f)
Heptachlor (MS)	8081	17-138	<=38	0.19	1.7	1,000 (b)
Heptachlor epoxide	8081	15-142	<=40	0.13	1.7	600 (b)
Methoxychlor	8081	24-152	<=40	0.28	17	1,000,000 (b)
Toxaphene	8081	41-126	<=50	11	170	5,200 (b)
<b>Surrogates</b>						
Tetrachloro-m-xylene (TCMX)	8081	30-150	NA	NA	NA	
Decachlorobiphenyl (DCB)	8081	30-150	NA	NA	NA	
<b>680 Table - Soil</b>						
Monochlorobiphenyls	680	30-130	<=50	0.62	3.3	1000 (b)
Dihlorobiphenyls	680	30-130	<=50	0.70	3.3	1000 (b)
Trichlorobiphenyls	680	30-130	<=50	0.69	3.3	1000 (b)
Tetrachlorobiphenyls	680	40-140	<=50	1.3	6.7	1000 (b)
Pentachlorobiphenyls	680	40-140	<=50	0.88	6.7	1000 (b)
Hexachlorobiphenyls	680	40-140	<=50	0.95	6.7	1000 (b)
Heptachlorobiphenyls	680	40-140	<=50	1.4	10	1000 (b)
Octachlorobiphenyls	680	40-140	<=50	1.3	10	1000 (b)
Nonachlorobiphenyls	680	30-130	<=50	2.6	17	1000 (b)
Decachlorobiphenyl	680	30-130	<=50	2.6	17	1000 (b)
<b>Surrogate</b>						
Decachlorobiphenyl-13C12	680	30-130	NA	NA	NA	

**TABLE 2C**  
**LABORATORY CONTROL LIMITS AND DETECTION LIMITS**

**8151 Table - Soil**

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
2,4-D (MS)	8151	19-153	<=47	2.4	8.3	2,000,000 (b)
Dalapon	8151	10-170	<=40	2	2000	6,100,000 (b)
2,4-DB	8151	20-160	<=40	1.1	8.3	4,900,000 (a)
Dicamba	8151	20-160	<=40	1.7	20	18,000,000 (a)
Dichlorprop	8151	30-170	<=40	0.8	100	na
MCPA	8151	10-130	<=50	74	2000	310,000 (a)
MCPP	8151	10-130	<=50	120	2000	620,000 (a)
Pentachlorophenol	8151	10-150	<=40	0.72	17	24,000 (b)
2,4,5-T (MS)	8151	14-143	<=59	0.87	8.3	6,200,000 (a)
2,4,5-TP (Silvex) (MS)	8151	27-120	<=51	1.5	8.3	1,600,000 (b)
<b>Surrogates</b>						
2,4-Dichlorophenyl acetic acid (DCAA)	8151	30-189	NA	NA	NA	

(a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.

(b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/ Inhalation Scenario. IEPA 2002.

(c) Due to structural similarities the value for gamma-BHC was used.

(d) Due to structural similarities the value for chlordane was used.

(e) Due to structural similarities the value for endosulfan was used.

(f) Due to structural similarities the value for endrin was used.

**TABLE 2D**  
**LABORATORY CONTROL LIMITS AND DETECTION LIMITS**

<b>8280A Table - Soil</b>						
<b>Parameter</b>	<b>Method</b>	<b>Accuracy</b>	<b>Precision</b>	<b>MDL (ug/kg)</b>	<b>PQL (ug/kg)</b>	<b>DQL (ug/kg)</b>
2,3,7,8-TCDD	8280	66-139	<=50	NA	1	1 (a)
1,2,3,7,8-PeCDD	8280	55-145	<=50	NA	2.5	1 (a)
1,2,3,4,7,8-HxCDD*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,6,7,8-HxCDD	8280	63-135	<=50	NA	2.5	1 (a)
1,2,3,7,8,9-HxCDD*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,4,6,7,8-HpCDD	8280	55-138	<=50	NA	2.5	1 (a)
OCDD	8280	52-139	<=50	NA	5	1 (a)
2,3,7,8-TCDF	8280	70-128	<=50	NA	1	1 (a)
1,2,3,7,8-PeCDF	8280	59-137	<=50	NA	2.5	1 (a)
2,3,4,7,8-PeCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,4,7,8-HxCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,6,7,8-HxCDF	8280	64-136	<=50	NA	2.5	1 (a)
2,3,4,6,7,8-HxCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,7,8,9-HxCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,4,6,7,8-HpCDF	8280	73-130	<=50	NA	2.5	1 (a)
1,2,3,4,7,8,9-HpCDF*	8280	50-150	<=50	NA	2.5	1 (a)
OCDF	8280	60-136	<=50	NA	5	1 (a)
<b>Internal Standards</b>						
13C-2,3,7,8-TCDF	8280	25-150	NA	NA		
13C-2,3,7,8-TCDD	8280	25-150	NA	NA		
13C-1,2,3,6,7,8-HxCDD	8280	25-150	NA	NA		
13C-1,2,3,4,6,7,8-HpCDF	8280	25-150	NA	NA		
13C-OCDD	8280	25-150	NA	NA		
<b>Surrogate</b>						
37Cl-2,3,7,8-TCDD	8280	25-150	NA	NA		

**Notes:**

NA = Not Applicable

(\*) = Compound is not a method specified control analyte. All limits are advisory.

Source: STL Sacramento

(a) USEPA 1998, Approach for Addressing Dioxins in Soil at CERCLA and RCRA sites. Value for Dioxins.

# TABLE 2E LABORATORY CONTROL LIMITS AND DETECTION LIMITS



## 6010 Table - Soil

STL Savannah

Parameter	Method	Accuracy	Precision	MDL (mg/kg)	PQL (mg/kg)	DQL (mg/kg)
Aluminum (ICP)	6010	75-125	<=20	1	20	100,000 (a)
Antimony (ICP)	6010	75-125	<=20	0.45	2	82 (b)
Arsenic (ICP)	6010	75-125	<=20	0.34	1	61 (b)
Barium (ICP)	6010	75-125	<=20	0.04	1	14,000 (b)
Beryllium (ICP)	6010	75-125	<=20	0.015	0.4	410 (b)
Cadmium (ICP)	6010	75-125	<=20	0.037	0.5	200 (b)
Calcium (ICP)	6010	75-125	<=20	1.8	50	NA
Chromium (ICP)	6010	75-125	<=20	0.077	1	420 (b)
Cobalt (ICP)	6010	75-125	<=20	0.055	1	12,000 (b)
Copper (ICP)	6010	75-125	<=20	0.15	2	8200 (b)
Iron (ICP)	6010	75-125	<=20	2.5	5	100,000 (a)
Lead (ICP)	6010	75-125	<=20	0.21	0.5	400 (b)
Magnesium (ICP)	6010	75-125	<=20	0.68	50	NA
Manganese (ICP)	6010	75-125	<=20	0.11	1	8,700 (b)
Nickel (ICP)	6010	75-125	<=20	0.18	4	4,100 (b)
Potassium (ICP)	6010	75-125	<=20	1.3	100	NA
Selenium (ICP)	6010	75-125	<=20	0.53	1	1,000 (b)
Silver (ICP)	6010	75-125	<=20	0.091	1	1,000 (b)
Sodium (ICP)	6010	75-125	<=20	16	50	NA
Thallium (ICP)	6010	75-125	<=20	0.52	1	160 (b)
Vanadium (ICP)	6010	75-125	<=20	0.096	1	1,400 (b)
Zinc (ICP)	6010	75-125	<=20	1.4	2	61,000 (b)
Cyanide (ICP)	9010	75-125	<=30	0.5	1	4,100 (b)
Mercury (ICP)	7471	80-120	<=20	0.0043	0.02	61 (b)

Notes:

NA = Not Applicable

(a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.

(b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/ Inhalation Scenario. IEPA 2002.



**TABLE 3**  
**Field Sampling Summary for Chemical Analyses**

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples	Field Duplicate	QC Sample Frequency MS/MSD /Spike Duplicate*	Trip Blank	Equip. Blank**
VOCs (EPA Method 8260B) <sup>1</sup>	soil	3- Encore sampler™ (or in accordance with USEPA Method 5035)	4°C	Transferred to soil container or analyzed 48 hours from collection	61 surface 60 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (12)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples) (6)	One per 10 samples as required (12)
SVOCs (EPA Method 8270C) <sup>1</sup>	soil	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	61 surface 60 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (12)	NA	One per 20 samples or one per matrix (for less than 20 samples) (6)	One per 10 samples as required (12)
Pesticides, Herbicides (EPA Methods 8081A, 8151) <sup>1</sup>	soil	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	31 surface 30 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (6)	NA	One per 20 samples or one per matrix (for less than 20 samples) (4)	One per 10 samples as required (6)
PCBs (EPA Method 680) <sup>2</sup>	soil	500 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	47 surface 46 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (10)	NA	One per 20 samples or one per matrix (for less than 20 samples) (5)	One per 10 samples as required (10)
***Dioxin, Dibenzofuran (EPA Method 8280A) <sup>1</sup>	soil	100 grams in 4 oz. amber glass jar with Teflon® lined lid	4°C	30 days from collection to extraction; 45 days from extraction to analysis	47 surface 46 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (10)	NA	One per 20 samples or one per matrix (for less than 20 samples) (5)	One per 10 samples as required (10)
Metals (EPA Method 6010B) <sup>1</sup>	soil	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container	4°C	180 days from collection generation, 180 days from extraction to analysis	47 surface 46 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (10)	NA	One per 20 samples or one per matrix (for less than 20 samples) (10)	One per 10 samples as required (5)

**Notes:**

- \* MS/MSD indicates matrix spike/matrix spike duplicate sample for organic analyses. Spike duplicate is performed for inorganic analyses.
- \*\* Field/equipment blank is required at a frequency of one per 10 samples or one per matrix if less than ten samples are collected. Equipment blank is not required if disposable equipment is used.
- \*\*\* For dioxin and dibenzofuran sample collection, QC samples, including MS/MSD and field duplicates must be clearly noted on the chain-of-custody.

Equip. indicates equipment.

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

NA indicates not applicable.

1 USEPA. 1996a. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846*, 3<sup>rd</sup> Edition. Washington D.C.

2 Phone conversation with Steve White from Savannah Laboratory on February 6, 2001.

**TABLE 4A**  
**VOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8260B**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Holding times	Samples must be extracted and analyzed within holding time.	VOCs: Analyze within 14 days from collection.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify QAO* immediately since re-sampling may be required. Document corrective action in the case narrative.
MS Tuning	Once every 12 hours prior to initial calibration and calibration verifications.	<ol style="list-style-type: none"> <li>1. BFB key ions and abundance criteria listed in the method must be met for all 9 ions and analyses must be performed within 12 hours of injection of the BFB.</li> <li>2. Part of the BFB peak will not be background subtracted to meet tune criteria.</li> <li>3. Documentation of all BFB analyses and evaluation must be included in the data packages.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tune the mass spectrometer.</li> <li>2. Document corrective action in the case narrative –samples cannot be analyzed until control limit criteria have been met.</li> </ol>
Initial Calibration	Prior to sample analysis and when calibration verifications criteria are not met. Initial calibration will contain all target analytes in each standard.	<ol style="list-style-type: none"> <li>1. Five concentrations bracketing expected concentration range for all compounds of interest; one std must be near the PQL.</li> <li>2. CCC compounds &lt;30% RSD, remaining compounds ≤50% RSD.</li> <li>3. SPCC RF as listed in method, non-SPCC RF ≥ 0.050 RF except for ketones and 2-chloroethyl vinyl ether with RF ≥ 0.010.</li> <li>4. For compound with %RSD &gt;15, quantitation must be performed using a separate calibration curve and the COD must be &gt; 0.99.</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify and correct problem.</li> <li>2. If criteria are still not met, recalibrate.</li> <li>3. Document corrective action in the case narrative – samples cannot be analyzed until calibration control limit criteria are met.</li> </ol> <p>Contact QAO* to discuss problem target analytes such as 2-chloroethyl vinyl ether before proceeding with analysis.</p>
Internal Standards	All samples and blanks (including MS/MSD)	<ol style="list-style-type: none"> <li>1. Response –50% - +100% of internal standards from continuing calibration of the day.</li> <li>2. RT must be ± 30 sec. From associated calibration verification standard of that sequence.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reanalyze.</li> <li>2. If still outside of the limits, report both analyses, and contact the QAO*.</li> <li>3. Document corrective action in the case narrative.</li> </ol> <p>Special Circumstances:  If matrix interferences is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> <li>1. Reanalyze (may be at a higher dilution)</li> <li>2. If internal standard is &gt;10%, report both runs.</li> <li>3. In internal standard is &lt;10%, report both runs and contact QAO*.</li> </ol>

**TABLE 4A**  
**VOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8260B**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Surrogate Spike	All samples and blanks (including MS/MSD)	Recovery within laboratory control limits.	<ol style="list-style-type: none"> <li>1. Reanalyze any environmental or QC sample with surrogates that exceed control limits.</li> <li>2. If still outside of the limits, report both analyses and contact the QAO*.</li> <li>4. Document corrective action in the case narrative.</li> </ol> <p>Special Circumstances:            If matrix interferences is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> <li>1. Reanalyze (may be at a higher dilution)</li> <li>2. If surrogate standard is &gt;10%, report both runs.</li> <li>3. In surrogate standard is &lt;10%, report both runs and contact QAO*.</li> </ol>
Matrix Spike/Matrix Spike Dup. (MS/MSD) Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery and RPD within laboratory control limits.  Spike must contain target analysis.	<ol style="list-style-type: none"> <li>1. Reanalyze if &lt;10%.</li> <li>2. If reanalysis is still &lt;10%, report both analyses and document in the case narrative.</li> <li>3. If &gt;10% and LCS criteria are met, document in case narrative; no additional corrective action required.</li> <li>4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e., surrogate recoveries for extraction efficiency and calibration data for instrument performance issues, and contact QAO*. Re-extract or reanalyze samples and associated MS/MSD and LCSs as required.</li> </ol>
Field Dup. Analysis	Collected 1 per matrix; every 10 samples of similar matrix	50% RPD for waters and 100% RPD for soil	If these criteria are not met, sample results will be evaluated on a case by case basis.
Percent solids	For soil samples, the percent solids will be determined and sample results will be corrective for percent solids.	Not applicable	Not applicable
Continuing Calibration	Every 12 hours. Calibration verification will contain target analytes at a concentration that is representative of the midpoint of the initial calibration.	<ol style="list-style-type: none"> <li>1. Within method specified criteria, percent drift or percent difference (%D) <math>\leq 20</math> for CCC and <math>\leq 50</math> for remaining compounds. SPCC RF as listed in method; non SPCC RF <math>\geq 0.050</math> except for Ketones and 2-CEVE with RF of <math>\geq 0.010</math>.</li> <li>2. The internal standards areas and retention times must meet the method criteria.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-analyze</li> <li>2. If criteria are still not met, identify and correct problems, recalibrate and notify QAO.</li> <li>3. Document corrective action in the case narrative- samples cannot be analyzed until calibration control limit criteria are met. If the laboratory chooses to apply the grand mean exception (average % drift or % difference is less than 15 %) the QAO will be contacted prior to proceeding with analysis.</li> </ol>

**Notes:**

\* Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in Section 9.2.2 of this QAPP.

QAO\* indicates that communications with the QAO will be documented and included in the data packages.

**TABLE 4B**  
**SEMIVOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8270C**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS\***

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	SVOCs: Extract within 7 days for aqueous and 14 days for soil samples from collection. Analyze extracts within 40 days of extraction.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO* immediately since re-sampling may be required.
MS Tuning	Once every 12 hours prior to initial calibration and calibration verification.	<ol style="list-style-type: none"> <li>1. DFTPP key ions and abundance criteria listed in the method must be met for all 13 ions and analyses must be performed within 12 hours of injection of the DFTPP. Part of the DFTPP peak will not be background subtracted to meet tune criteria.</li> <li>2. Documentation of all DFTPP analyses and evaluations must be included in the data packages.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tune the mass spectrometer.</li> <li>2. Document corrective action in the case narrative – samples cannot be analyzed until control limit criteria have been met.</li> </ol>
Initial Calibration	Prior to sample analysis and when calibration verification criteria are not met. Initial calibration will contain all target analytes in each standard.	<ol style="list-style-type: none"> <li>6. Five concentrations bracketing expected concentration range for all compounds of interest; one standard must be near the PQL.</li> <li>7. CCC compounds meet method RSD, remaining compounds <math>\leq 50\%</math> RSD.</li> <li>8. SPCC RF as listed in method, non-SPCC <math>\geq 0.050</math> RF.</li> <li>9. For compounds with <math>\%RSD &gt; 15</math>, quantification must be performed using a separate calibration curve and the COD must be <math>\geq 0.99</math>.</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify and correct problem.</li> <li>2. If criteria are still not met, recalibrate.</li> <li>3. Document corrective action in the case narrative – samples cannot be analyzed until calibration control limit criteria are met.</li> </ol> <p>Contact QAO* to discuss problem target analytes such as 2-chloroethyl vinyl ether before proceeding with analysis.</p>
Calibration Verification	Every 12 hours, following DFTPP. Calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	<ol style="list-style-type: none"> <li>1. Within method specified criteria, percent drift or percent difference (<math>\%D</math>) <math>\leq 20</math> for CCC compounds and <math>\leq 50\%D</math> for remaining compounds, SPCC RF as listed in method, non-SPCC <math>\geq 0.050</math>.</li> <li>2. The internal standards areas and retention times must meet the method criteria.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reanalyze.</li> <li>2. If criteria are still not met, identify and correct problem, recalibrate and notify QAO*.</li> <li>3. Document corrective action in the case narrative – samples cannot be analyzed until calibration control limit criteria are met.</li> </ol> <p>If the laboratory chooses to apply the grand mean exception (average <math>\%</math> drift or <math>\%</math> difference is less than 15%), the QAO* will be contacted prior to proceeding with analysis.</p>
Surrogate Spike	All samples and blanks (including MS/MDS)	Recovery within laboratory control limits.	<ol style="list-style-type: none"> <li>1. Reanalyze if more than 1 AE or 1 BS fails, or if any one surrogate <math>\%R</math> is <math>&lt; 10\%</math>.</li> <li>2. If recovery is still outside control limits and if the recovery is <math>&lt; 10\%</math>, re-extract if still in holding time.</li> <li>3. If recovery is still outside control limits, and if recovery is <math>&gt; 10\%</math>, report both analyses.</li> <li>4. Document corrective action in the case narrative.</li> </ol> <p>Special Circumstances:  If matrix interference is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> <li>1. Reanalyze (may be at a higher dilution).</li> <li>2. If surrogate recovery is <math>&gt; 10\%</math>, report both runs.</li> </ol>

**TABLE 4B**  
**SEMIVOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8270C**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS\***

Audit	Frequency	Control Limits	Corrective Action
Matrix Spike/Matrix Spike Dup. (MS/MSD) Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery and RPD within laboratory control limits.  Spike must contain target analysis.	3. If surrogate recovery is <10%, report both runs and contact QAO*.  1. Reanalyze if <10%. 2. If reanalysis is still <10%, report both analyses and document in the case narrative. 3. If >10% and LCS criteria are met, document in case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e., surrogate recoveries for extraction efficiency and calibration data for instrument performance issues, and contact QAO* and re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
Field Dup. Analysis	Collected 1 per matrix; every 10 samples of similar matrix	50% RPD for waters and 100% RPD for soil	If these criteria are not met, sample results will be evaluated on a case by case basis.
Internal Standard	All samples and blanks (including MS/MSD).	1. Response -50% to + 100% of internal standards from continuing calibration of the day. 2. RT must be $\pm 30$ sec. From associated calibration verification standard of that sequence.	1. Re-analyze 2. If still outside of the limits, report both analyses and contact the QAO. 3. Document corrective action in the case narrative. Special Circumstances: If matrix interferences are present (as demonstrated by the lab and documented in the case narrative): Re-analyze (may be at a higher dilution) If internal standard in >10%, report both runs. If internal standard is <10%, report both runs and contact QAO.

**Notes:**

\* Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in Section 9.2.2 of this QAPP.

QAO\* indicates that communications with the QAO will be documented and included in the data packages.

**TABLE 4C**  
**PESTICIDES SW-846 METHOD 8081A AND HERBICIDES SW-846 METHOD 8151A**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Holding times	Samples must be extracted and analyzed within holding time.	Extract within 7 days for aqueous and 14 days for soil samples from collection. Analyze extracts within 40 days.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify QAO immediately since re-sampling may be required.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	<ol style="list-style-type: none"> <li>1. Minimally five concentrations, one calibration standard must be at concentration less than or equal to the PQL.</li> <li>2. Toxaphene, technical chlordane require a single point calibration. If detected in samples, the samples are re-analyzed behind a five point calibration for each detected analyte.</li> <li>3. If RSD &lt;20% the average RRF may be used for quantitation. If RSD &gt;20% a first or second order calibration curve with a correlation coefficient &gt;0.99 must be used for quantitation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify and correct problem.</li> <li>2. Recalibration instrument; samples must not be analyzed until initial calibration criteria are met.</li> </ol>
Calibration Verification	<p>Calibration standards must contain target compounds at mid-range concentration.</p> <p>Minimally, analyze calibration standards daily and every 12 hours. Calibration verification standards should be analyzed every 20 samples.</p>	%D <15%	<ol style="list-style-type: none"> <li>1. Reanalyze.</li> <li>2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.</li> </ol> <p>If the laboratory chooses to apply the grand mean exception (average % drift or % difference is less than 15%), the QAO* will be contacted prior to proceeding with analysis.</p>
Retention Time Windows	Retention time windows must be established in accordance with USEPA method 8000 or relative retention times must be used if internal standards are employed.	Compounds must be within established retention time windows or within laboratory established relative retention time criteria for the succeeding calibration standards.	<ol style="list-style-type: none"> <li>1. Reanalyze.</li> <li>2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard.</li> </ol>

**TABLE 4C**  
**PESTICIDES SW-846 METHOD 8081A AND HERBICIDES SW-846 METHOD 8151A**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Surrogate Spike	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specific surrogate compounds.	<ol style="list-style-type: none"> <li>1. Recovery within laboratory control limits.</li> <li>2. Corrective action is not required if one of the two required surrogates has recovery outside of control limits if the recovery is &gt;10%.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reanalyze</li> <li>2. If recovery is still outside control limits but &gt;10%, document in case narrative report.</li> <li>3. If recovery is &lt;10% with re-analysis, re-extract and re-analyze the sample if the holding time has not elapsed. If holding time has elapsed, notify the QAO immediately prior to proceeding since resampling may be required.</li> </ol> <p>Special Circumstances:  If matrix interferences is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> <li>1. Reanalyze (may be at a higher dilution)</li> <li>2. If surrogate standard is &gt;10%, report runs.</li> <li>3. In surrogate standard is &lt;10%, contact QAO*.</li> </ol>
Identification	Samples, blanks, and QC data.	<ol style="list-style-type: none"> <li>1. Retention times must be within established retention time windows or must meet relative retention time criteria.</li> <li>2. Confirmation analysis is required.</li> </ol>	<ol style="list-style-type: none"> <li>1. Investigate problem; re-analyze calibration standards to check for retention time shift.</li> </ol>
Quantitation	Samples, blanks, and QC data.	<ol style="list-style-type: none"> <li>1. Internal and external standard method. Verify concentration is within linear calibration range.</li> <li>2. For DROs, use the sum of the areas of peaks eluting between C10 and C28.</li> <li>3. Every effort must be made to meet specified PQL requirements. Soil samples concentrations must be corrected to dry weight.</li> </ol>	<ol style="list-style-type: none"> <li>1. If concentration is above linear calibration range, dilute sample and re-analyze. Dilution should result in concentration in the upper calibration range of the instrument.</li> </ol>
Field/ Equipment Blank Analysis	Collected one per sampling equipment and after every 10 samples.	Compounds concentrations must be <PQL.	<ol style="list-style-type: none"> <li>1. Investigate problem; re-analyze to verify laboratory cross contamination is not a factor.</li> <li>2. Notify the QAO immediately since resampling may be necessary.</li> </ol>



**TABLE 4D**  
**PCBs METHOD 680 BY SELECTED ION MONITORING (SIM) MODE**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	Extract within 7 days for aqueous and 14 days for soil samples from collection. Analyze extracts within 40 days of extraction.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO* immediately since re-sampling may be required.
MS Tuning	At the beginning of the 12 hour sequence.  Prior to calibration, blank, sample and QC sample analysis.	<ol style="list-style-type: none"> <li>1. Tune instrument in accordance with Method 680.</li> <li>2. Size of DFTPP peak should be within instrument specific established area window.</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify and correct problem.</li> <li>2. Re-tune the mass spectrometer; samples must not be analyzed until tuning criteria are met.</li> </ol>
Initial Calibration	Prior to start up after tuning and when criteria are exceeded for continuing calibration.	<ol style="list-style-type: none"> <li>1. Minimally five concentrations, one calibration standard must be at concentration less than or equal to the PQL.</li> <li>2. Toxaphene, technical chlordane require a single point calibration. If detected in samples, the samples are re-analyzed behind a five point calibration for each detected analyte.</li> <li>3. If RSD &lt;20% the average RRF may be used for quantitation. If RSD &gt;20% a first or second order calibration curve with a correlation coefficient &gt;0.99 must be used for quantitation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify and correct problem.</li> <li>2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.</li> </ol>
Calibration Verification	<p>Calibration standards must contain target compounds at mid-range concentration.</p> <p>Minimally, analyze calibration standards prior to sample analysis and at the end of the sample sequence, and every 12 hours.</p>	<ol style="list-style-type: none"> <li>1. %D &lt;20% for water, 30% for soil.</li> <li>2. Mass abundance ratio of all calibration congeners within acceptable range.</li> <li>3. Baseline separators of PCB congener #87 from #154 and #77.</li> <li>4. Signal to noise ratio of <math>\geq 5</math> for decachlorobiphenyl ion #499 and chrysene-d12 ion #241.</li> <li>5. Decachlorobiphenyl mass abundances for mass 500 &gt;70% and &lt;95% for mass 498.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reanalyze.</li> <li>2. If criteria are still not met, identify and correct problem, recalibrate; re-analyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.</li> </ol>

**TABLE 4D**  
**PCBs METHOD 680 BY SELECTED ION MONITORING (SIM) MODE**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Identification	Samples, blanks, and QC data.	<ol style="list-style-type: none"> <li>1. The retention time must be within the corresponding retention time established by the window defining mixture for each chlorination level.</li> <li>2. The ion current response for both ions must reach a maximum with <math>\pm 1</math> scan.</li> <li>3. Ion abundance ratios specified in SOP must be met.</li> <li>4. The area of the ions must be <math>&gt;3</math> times the background noise.</li> <li>5. At least one ion in the M-70 cluster must be present.</li> <li>6. Evaluate PCBs in the Cl-3 to Cl-7 range for coeluting PCBs. See SOP Section 11.1.3.</li> <li>7. Examine data for presence of PCB of higher chlorination level if both ions and M-70 ions are present and the ratio does not fall within acceptable limits.</li> </ol>	<ol style="list-style-type: none"> <li>1. If identification criteria are not all met, but in the judgment of the operator the target compound is present, proceed with quantitation and document reasoning in the data package.</li> </ol>
Equipment Blank Analysis	1 per sampling equipment and after collection of 10 samples.	Compounds concentration must be $<$ reporting limit.	<ol style="list-style-type: none"> <li>1. Investigate problem; re-analyze to verify laboratory cross contamination is not a factor.</li> <li>2. Notify QAO Officer since resampling may be necessary.</li> </ol>
Field Duplicate Analysis	Collected every 10 samples	<p>Aqueous: RPD <math>\leq 50\%</math> for results <math>&gt;5 \times \text{CRQL}</math>.</p> <p>Soils: RPD <math>\leq 100\%</math> for results <math>&gt;5 \times \text{CRQL}</math>.</p> <p>For Results <math>&lt;5 \times \text{CRQL}</math> must agree with <math>\pm 2 \times \text{CRQL}</math> for aqueous and soils.</p>	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process..

**TABLE 4E**  
**PCDD/PCDF METHOD 8280A QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

<b>Audit</b>	<b>Frequency</b>	<b>Control Limits</b>	<b>Corrective Action</b>
Holding Time	Samples must be extracted and analyzed within holding time.	Extract within 30 days of VTSR for extraction, 45 days for analysis of samples.  Cleanup using alumina, silica gel and activated carbon as needed.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO immediately since re-sampling may be required.
MS Tuning	At the beginning of the 12 hour sequence. Prior to calibration, blank, sample and QC sample analysis.	Tune instrument using FC43 in accordance with Method 8280A. Total cycle time must be $\leq 1.0$ second	1. Identify and correct problem. 2. Re-tune the mass spectrometer; samples must not be analyzed until tuning criteria are met.
GC Column Performance Check (WDM)	At the beginning of 12 hour sequence, prior to ICAL or CCAL.	Must contain the first and last for each homologous series tetra- through heptachlorinated congeners.  Column resolution must be evaluated in the CCAL per Sections 7.12.1 and 7.13.3.6 of Method 8280A. Additionally, instrument sensitivity check (CC1) must be analyzed at the end of 12-hour period per Section 7.13.3.7 of Method 8280A.	1. Identify and correct problem. 2. Re-analyze; samples must not be analyzed until GC performance check criteria are established.
Selective Ion Monitoring (SIM) Descriptions	Acquire SIM data for all ions listed in the five descriptors.	The ions listed in Method 8280A, Table 7 must be monitored. The tetra and penta chlorinated dioxins and furans can be combined.	1. Identify and correct problem. 2. Document in case narrative.
Surrogate or Alternate Standards	Samples, blanks, and MS/MSDs are to be spiked with the compounds listed in Table 3 of Method 8280A.	Percent recoveries must be within 8280A criteria.	1. Re-extract and/or re-analyze. 2. If re-extraction and re-analysis does not solve problem and other QC criteria were met, submit both runs and discuss in narrative report.
Recovery Standard	Consists of 13C-1,2,3,4-TCDD and 13C-1,2,3,7,8,9-HxCDD, which are added to field samples, blanks, and QC samples prior to sample injection.	Recovery standards are used to calculate internal standard recovery. The recovery standard must elute within 10 seconds of the same standards in the continuing calibration at the start of the 12-hour analytical sequence.	1. Re-analyze. 2. If re-extraction and re-analysis does not solve problem and other QC criteria were met, submit both runs and discuss in narrative report.

**TABLE 4E**  
**PCDD/PCDF METHOD 8280A QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

<b>Audit</b>	<b>Frequency</b>	<b>Control Limits</b>	<b>Corrective Action</b>
Method Blank Analysis	1/20 samples of similar matrix extracted at the same time, analyzed between the calibration standard and samples.	Compound concentrations must be < CRQL (PQL).	<ol style="list-style-type: none"> <li>1. Re-analyze</li> <li>2. Assess impact on data.</li> <li>3. If limits are still exceeded and impact is adverse, re-extract and re-analyze method blank and associated samples if holding times have not elapsed.</li> <li>4. If holding times have elapsed, contact QAO Manager since re-sampling may be required.</li> </ol>
MS/MSD Analysis	1/matrix type and every 20 samples of similar matrix.	Recovery and RPD within Table 6I limits.	<ol style="list-style-type: none"> <li>1. Re-analyze.</li> <li>2. Recovery or RPD is still outside limits, document in case narrative report.</li> </ol>
Duplicate Analysis	1/ sample batch.	RPD within 50%.	<ol style="list-style-type: none"> <li>1. Re-analyze.</li> <li>2. RPD is still outside limits, document in case narrative report.</li> </ol>
Quantitation	Samples, blanks, and QC data.	<p>Based upon five-point calibration curve for each homologue. (See Table 1 of Method 8280A)</p> <p>Quantitation based upon Section 7.15 of Method 8280A.</p> <p>Extract should be analyzed on DB-225 column if 2,3,7,8-TCDF is detected and the TEQ value is above the levels stated in Section 7.15.8.2.1 of Method 8280A</p>	<ol style="list-style-type: none"> <li>1. If peak is saturated, dilute sample and re-analyze.</li> <li>2. Perform appropriate cleanup procedures as necessary to minimize sample matrix effects.</li> <li>3. If PCDD/PCDF conc. is greater than the calibration limit. A dilution analysis will be performed.</li> </ol>
Sample Specific Estimated Detection Limit (EDL)	Sample specific EDL is the concentration of an analyte required to produce a signal with a peak height of at least 2.5 times the background signal.	Calculate an EDL for each 2,3,7,8-substituted congener that is not identified.	Not Applicable.

**TABLE 4E**  
**PCDD/PCDF METHOD 8280A QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Identification	Samples, Blanks, and QC data	<p>For PCDD/PCDF congeners, which has labeled internal or recovery standard present, the retention time of sample component for the two Quantitation ions must be within <math>-1</math> to <math>+3</math> seconds of the labeled standard.</p> <p>For other compounds, the retention time must be within the corresponding homologous retention time established by the GC column performance check standard.</p> <p>The ion current response for both ions must reach a maximum with <math>\pm 1</math> scan. Ion abundance ratios specified in Method must be met.</p> <p>Signal-to-noise ratio (S/N): all ion current intensities must be 2.5 times for positive identification of a PCDD/PCDF compound or a group of coeluting isomers.</p>	<p>1. If identification criteria are not all met, but in the judgment of the operator the compound is present, proceed with Quantitation and document reasoning in the data package.</p>
Calibration	<p>Before any samples are analyzed, when criteria are exceeded for the continuing calibration verification, and if calibration, sample fortification (internal standard) or recovery standard solutions are replaced with a different lot.</p> <p>Minimally, five concentration calibration solutions are required using the specifications and calibration ranges indicated in Table 1 of Method 8280A.</p>	<p>Relative ion abundance criteria specified in Method 8280A Table 9 must be met.</p> <p>The S/N ratio for each GC signal, including the labeled internal standards, must be <math>\geq 10</math>.</p> <p>The %RPD for the unlabeled analytes and labeled internal standards must be <math>\leq 15\%</math>.</p>	<p>1. Identify and correct problem.</p> <p>2. Recalibrate the instrument. Samples must not be analyzed until the initial calibration criteria are met.</p>

**TABLE 4F**  
**METALS SW-846 METHOD 6010B, MERCURY SW-846 METHOD 7470A, 7471A, AND CYANIDE SW-846 METHOD 9010B/9012A**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

<b>Audit</b>	<b>Frequency</b>	<b>Control Limits</b>	<b>Corrective Action</b>
Holding Times	Samples must be digested and analyzed within holding time.	Metals: Analyze 180 days from collection. Mercury: Analyze 28 days from collection. Cyanide: Analyze 14 days from collection.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO immediately since re-sampling may be required.
Calibration Verification (ICV, CCV)	Two point calibration for ICP. Five point calibration for remaining methods. Calibrate according to method and each time instrument is set up; verify at more frequent of 10% or each 2 hours. Also verify at the end of each run. Analyze highest mix standard before sample analysis (ICP only).  Standard at or below the PQL should be analyzed after initial calibration.  Mercury standard should be less than or equal to 5 times the PQL.	90% to 110% of expected value for ICP AA, colorimeter, and spectrophotometer.  80% to 120% of expected true value for Mercury.  Highest standard mix $\pm 5\%$ of true value for ICP.  Correlation coefficient for first or second order curve must be $\geq 0.995$ .	1. Re-analyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action – samples cannot be analyzed until calibration control limit criteria have been met.
Calibration Blank	At the beginning and end of run and at a rate of 10% during run.	Less than PQL.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action – samples cannot be analyzed until calibration control limit criteria have been met.
Preparation Blank Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater.	Less than PQL.	1. Re-analyze blank. 2. If limits are still exceeded, clean instrument and recalibrate. 3. Document corrective action – samples cannot be analyzed until calibration control limit criteria have been met.
Laboratory Duplicate or Matrix Spike Duplicate Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater	RPD less than in-house limits for conc > 5X PQL.  Abs. difference less than 2X PQL otherwise.	1. Investigate problem and reanalyze. 2. Document corrective action.

**TABLE 4F**  
**METALS SW-846 METHOD 6010B, MERCURY SW-846 METHOD 7470A, 7471A, AND CYANIDE SW-846 METHOD 9010B/9012A**  
**QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Field Dup. Analysis	Collected 1 per matrix; every 10 samples of similar matrix	50% RPD for waters and 100% RPD for soil.	If these criteria are not met, sample results will be evaluated on a case by case basis.
Furnace Analysis	Two samples in each analytical batch must be injected in duplicate and spiked; method of standard additions is required when the sample absorbance or concentration is $\geq 50\%$ of the spike concentration and the % recovery is not within control limits.	% Recovery 85% to 115%, Relative Standard Deviation <20%.  MSA correlation coefficient > 0.995.	<ol style="list-style-type: none"> <li>1. Dilute and reanalyze if &lt;40% recovery, reanalyze 40%-60% recovery and no MSA.</li> <li>2. If limits are still exceeded, qualify data.</li> <li>3. Document corrective action.</li> </ol>

**Note**

\*Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in Section 9.2.2 of this QAPP.  
 QAO\* indicates that communications with the QAO will be documented and included in the data packages.

**TABLE 5**  
**LABORATORY STANDARD OPERATING PROCEDURES (SOPS) AND QUALITY**  
**ASSURANCE MANUAL (AQM) FOR SEVERN TRENT LABORATORIES**  
**(Laboratories Located At Savannah, GA and Sacramento, CA)**

Laboratory SOP Site	SOP No.	SOP Date
Chlorinated Herbicides (Methods 615 and 8151A)	SG65	1/14/99
Total Cyanide and Cyanide Amenable to Chlorination by Manual Distillation	GE46-M	11/25/97
Mercury: Varian Spectra AA 20	ME26	5/1/98
Mercury Analysis: Leeman PS200	ME28	12/19/97
Mercury Preparation: Leeman AP200	ME29	1/20/98
Digestion Procedures for ICP Total Metals in Soils, Sediments, Wastes and Oils	ME51	7/6/98
Digestion Procedures for Graphite Furnace Atomic Absorption Total Metals in Soils, Sediments, Wastes and Oils	ME61	7/6/98
Elements by ICP (Methods 200.7 and 6010B)	ME70	6/19/98
Receipt Log Number Assignment and Distribution of Field Samples	CUO1	4/05/02
Internal Chain of Custody	CUO2	7/10/98
Preparation of Sampling Kits	CU15	6/24/98
Continuous Liquid-Liquid Extraction	EX30	8/27/98
Ultrasonic Extraction	EX40	2/20/98
Extraction of Chlorinated Herbicides in Water, Soils and Wastes	EX45	4/24/02
Zymark Extract Concentration Procedure	EX50	8/8/97
Preparation of SVOA Surrogate and Matrix Spiking Solutions	EX70	11/25/97
Total and Amenable Cyanide: Autoanalyzer Procedure	GE40	8/25/98
Total Cyanide: Autodistillation Procedure	GE41	5/1/98
Midi Distillation of Water and Soils for the Determination of Cyanide	GE43	3/6/98
Organochlorine Pesticides and PCBs	SG45	7/17/98
Graphite Furnace AA	ME75	3/26/98
Semivolatile Compounds by GC/MS	SM05	4/13/98
Extraction and Analysis of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans by DFLM01.0 including Revision DFLM01.1 and Method 8280A	SAC-ID-0011	10/15/98



## Figures

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**FIGURE 1**  
**EXAMPLE SAMPLE LABEL**

**SAMPLE LABEL**

<b>URS CORPORATION</b>	
<b>Project:</b>	
<b>Project Number:</b>	
<b>Date:</b>	<b>Time:</b>
<b>Sample I.D.</b>	
<b>Preservatives:</b>	
<b>Analysis:</b>	
<b>Samplers:</b>	

**SL** SAVANNAH LABORATORIES  
& ENVIRONMENTAL SERVICES, INC.

OFFICIAL SAMPLE SEAL

DATE	TIME	BY	BY

SOLUTIA W.G. KRUMMRICH PLANT SAUGET, ILLINOIS		PROJECT NO. 21561197.00001
<b>URS</b>		
DRN. BY: djd 11/26/02 DSGN. BY: at CHKD. BY:	Example Laboratory Internal Chain of Custody Form	FIG. NO. 2

FIGURE 3  
CHAIN OF CUSTODY RECORD

URS CORPORATION

SHEET \_\_\_\_ of \_\_\_\_

2318 MILLPARK DR.  
MARYLAND HEIGHTS, MISSOURI 63043  
314-429-0100

PROJECT NO:		PROJECT NAME:		NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS
SAMPLER'S: (Signature)										
DATE	TIME	SAMPLE I.D. NUMBER								
RELINQUISHED BY: (Signature)			DATE / TIME		RECEIVED BY: (Signature)				DATE / TIME	
RELINQUISHED BY: (Signature)			DATE / TIME		RECEIVED AT LAB BY: (Signature)				DATE / TIME	
METHOD OF SHIPMENT:					AIRBILL NO:					

